TYPE 740-B CAPACITANCE TEST BRIDGE

937

The Type 740-B Capacitance Test Bridge is a 60-cycle bridge for the measurement of capacitance and dissipation factor. The circuit, shown schematically below, is that of the conventional capacitance bridge. The null indicator consists of a tuned amplifier and an electron-ray tube.

RANGE AND ACCURACY

Capacitance Range: 5 $\mu\mu$f to 1100 μf.

Capacitance Accuracy: Within ±1% over main decade of CRL dial (1 to 11) for all multipliers except .0001.

Within ±1.5% or ±3 micromicrofarads, whichever is the larger, on the .0001 multiplier on the main decade of the CAP. dial. Below 100 micromicrofarads the error gradually increases to ±5 micromicrofarads as zero is approached.

Corrections for bridge zero capacitance are unnecessary because the zero capacitance value is negligible.

Dissipation Factor Range: 0 to 50%.

Dissipation Factor Accuracy: Within ±1.5% of full-scale reading for all capacitance multipliers except .0001.

On the .0001 capacitance multiplier a correction of 0.3% should be subtracted from the dial reading. When this correction is made the calibration is within ±2 divisions on the X1 multiplier and within ±1 division on the X10 multiplier.

On the lowest and highest capacitance ranges, where the sensitivity of balance is lower, this accuracy can be obtained by interpolation.

Note that the bridge reads in dissipation factor ($R\omega C$), which is related to power factor as the cotangent of the loss angle is to the cosine. The difference is negligible for power factors less than 10%.

INSTALLATION

1. Connect the bridge to a 60-cycle a-c line of proper voltage (power transformer can be connected for either 100- to 130-volt or 200- to 260-volt input) by means of the cord and plug supplied. The input power is about 15 watts.
2. Ground the bridge at panel terminal G.
3. Turn on power (ON-OFF) switch.

OPERATION

1. Connect the capacitor under test to the UNKNOWN terminals, making sure that the low terminal (if any) is connected to the bridge terminal engraved LOW.
2. If the approximate capacitance is known, set the MULTIPLY BY and CAPACITANCE dials to this value. If the approximate value is not known, set the SENSITIVITY control at about 5 and adjust the MULTIPLY BY switch until the pattern on the electron-ray tube opens.
3. Adjust the CAPACITANCE and DISSIPATION FACTOR dials until a null is reached, i.e., until the pattern on the electron-ray tube is at maximum deflection when the sensitivity is at maximum.

PRECAUTIONS

1. Keep the supply line away from the UNKNOWN terminals and samples being measured. This is extremely important when measuring on .0001 capacitance multiplier.
2. Do not use CRL dial below 1 except for measurements less than 100 micromicrofarads.
3. Sensitivity is best when the power supply has good waveform.

POLARIZING VOLTAGE

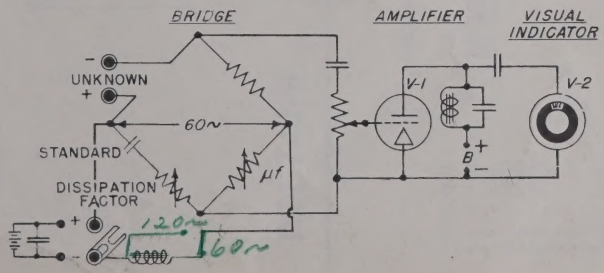
A d-c polarizing voltage (not over 500 volts) can be introduced at the DC and COND. terminals. Batteries are recommended as the source of polarizing voltage rather than an a-c rectifier filter system. The smallest available battery that will give the desired voltage is satisfactory because the only current drain is that caused by leakage in the capacitor under test.

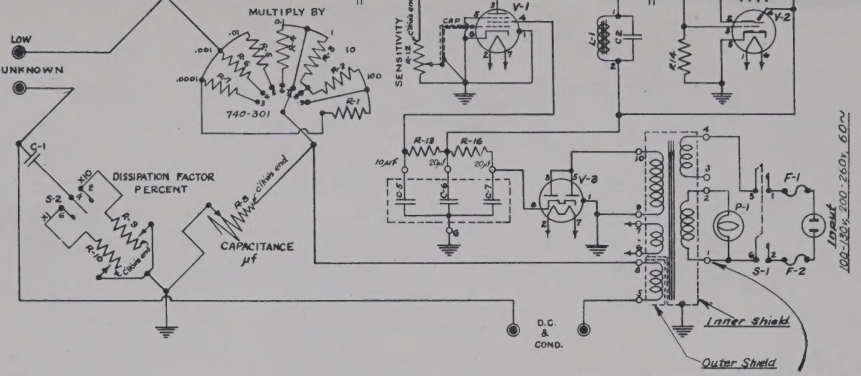
Connect a capacitor (10 μf or larger) across the d-c supply in order to avoid a drop in the 60-cycle bridge voltage caused by the internal impedance of the d-c supply.

If an a-c operated power supply is used, its capacitance to ground must be low, because this capacitance is shunted across the standard capacitor. The presence of a-c ripple may reduce the sensitivity of balance.

Make sure that the polarity of the voltage is correct for the capacitor under test. A simple convention to follow is to connect the negative terminal of the electrolytic capacitor under test to the LOW terminal of the bridge and the negative side of the d-c source to the right-hand DC and COND. terminals.

When no polarizing voltage is used, the DC and COND. terminals should be shorted with the link provided.





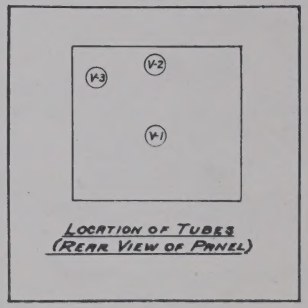
TYPE 740-B

PARTS LIST

RESISTORS	TUBES	CONDENSERS
R-1 = .9965 Ω	V-1 = RCA Type 6J7	C-1 = .09975 µf
R-2 = 9 Ω	V-2 = RCA Type 6E5	C-2 = 0.035 µf
R-3 = 90 Ω	V-3 = RCA Type 6X5-GT/G	C-3 = .02 µf
R-4 = 900 Ω		C-4 = .02 µf
R-5 = 10 kΩ		C-5 = 10 µf
R-6 = 100 kΩ		C-6 = 20 µf
R-7 = 1 MΩ		C-7 = 20 µf
R-8 = 11.2 k-11.7 kΩ		
R-9 = 13,120 - 13,380 Ω		MISCELLANEOUS
R-10 = 1312 - 1338 Ω		
R-12 = 1 MΩ		T-1 = Power Trans., 345-406-3
R-13 = 0.56 MΩ		L-1 = Choke, 345-426
R-14 = 3.3 MΩ		
R-15 = 3.3 MΩ		S-1 = D.P.S.T., 139-333
R-16 = 0.1 MΩ		S-2 = S.P.D.T., 139-320
		P-1 = 115-volt Pilot

FUSES

F-1 and 2 = 0.3 amp. Slow Blow 3AG (115v)
F-1 and 2 = 0.15 amp. Slow Blow 3AG (230v)



LOCATION OF TUBES
(REAR VIEW OF PANEL)

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS, U. S. A.

DWG. NO 740-5D

RESISTORS

R-1 = .3965Ω ±0.25%
R-2 = 9Ω ±0.1%
R-3 = 90Ω ±0.1%
R-4 = 900Ω ±0.1%
} 740-300

R-5 = 10KΩ ±0.1% 602-305
R-6 = 100KΩ ±0.1% REPR-17K
R-7 = 1MΩ ±0.25% REPR-18

R-8 = 11.2K-11.7KΩ, 433-300
R-9 = 13,120-13,380Ω, 214-401
R-10 = 1312 - 1338Ω, 214-402

R-12 = 1MΩ POSC-7

R-13 = 0.56MΩ REC-20BF
R-14 = 3.3MΩ REC-20BF
R-15 = 3.3MΩ REC-20BF
R-16 = 0.1MΩ REC-30BF

CONDENSERS

C-1 = .09975μf ±0.25% 0505-4060
C-2 = 0.035μf. COM-50B

C-3 = .02μf. COM-50B
C-4 = .02μf. COM-50B
C-5 = 10μf, 200V
C-6 = 20μf, 300V
C-7 = 20μf, 400V
} COEB-3 2

MISCELLANEOUS

T-1 = Power Trans., 345-406 3

L-1 = Choke, 345-426

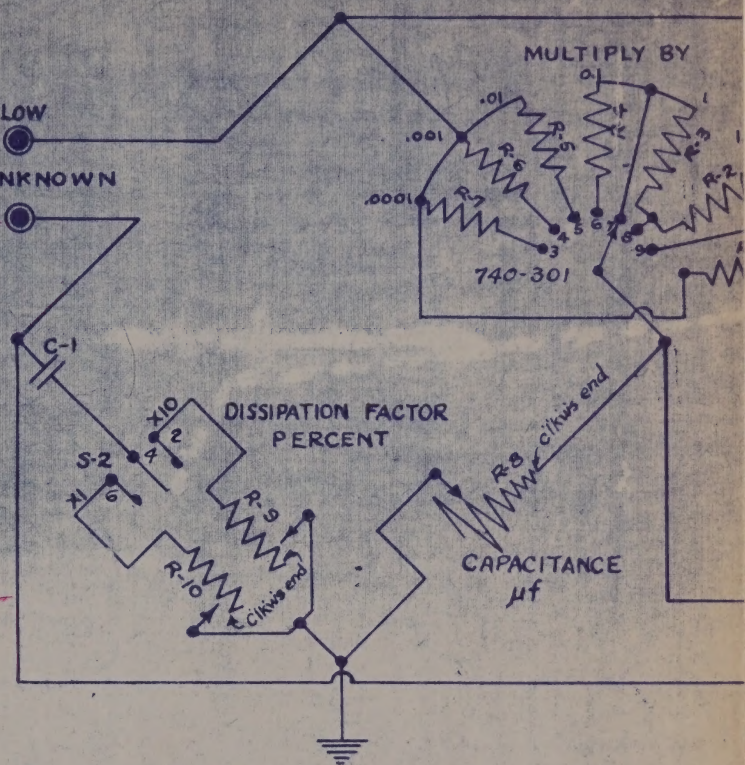
S-1 = D.P.S.T., 139-333
S-2 = S.P.D.T., 139-320

FUSES

F-1 = 0.3amp Slow Blow 3AG GR FUF-1
F-2 = 0.3amp Slow Blow 3AG GR FUF-1
(115V.)

F-1 = 0.15amp Slow Blow 3AG GR FUF-1
F-2 = 0.15amp Slow Blow 3AG GR FUF-1
(230V.)

P-1 = 115V. Pilot



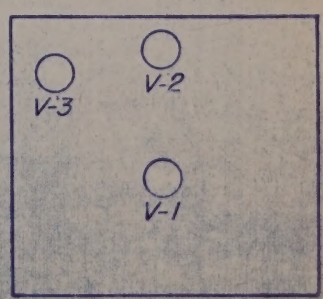
TUBES

V-1 = RCA Type 6J7
V-2 = RCA Type 6E5
V-3 = RCA Type 6X5-GT/G

P-1 = 115V Pilot lamp

V

740-B



LOCATION OF TUBES
(REAR VIEW OF PANEL)

DWG. NO 740-5D

RESISTORS

R-1	= .3965Ω ± 0.25%	740-300
R-2	= 9Ω ± 0.1%	740-300
R-3	= 90Ω ± 0.1%	740-300
R-4	= 900Ω ± 0.1%	740-300
R-5	= 10KΩ ± 0.1%	602-305
R-6	= 100KΩ ± 0.1%	REPR-17K
R-7	= 1MΩ ± 0.25%	REPR-18
R-8	= 11.2K-11.7KΩ	433-300
R-9	= 13,120-13,380Ω	214-401
R-10	= 1312-1338Ω	214-402
R-12	= 1MΩ	POSC-7
R-13	= 0.56MΩ	REC-20BF
R-14	= 3.3MΩ	REC-20BF
R-15	= 3.3MΩ	REC-20BF
R-16	= 0.1MΩ	REC-30BF

CONDENSERS

C-1	= .09975μf ± 0.25%	0505-4060
C-2	= 0.035μf	COM-50B
C-3	= .02μf	COM-50B
C-4	= .02μf	COM-50B
C-5	= 10μf, 200V	COEB-3 2
C-6	= 20μf, 300V	COEB-3 2
C-7	= 20μf, 400V	COEB-3 2

MISCELLANEOUS

T-1 = Power Trans., 345-406 3

L-1 = Choke, 345-426

S-1 = D.P.S.T., 139-333

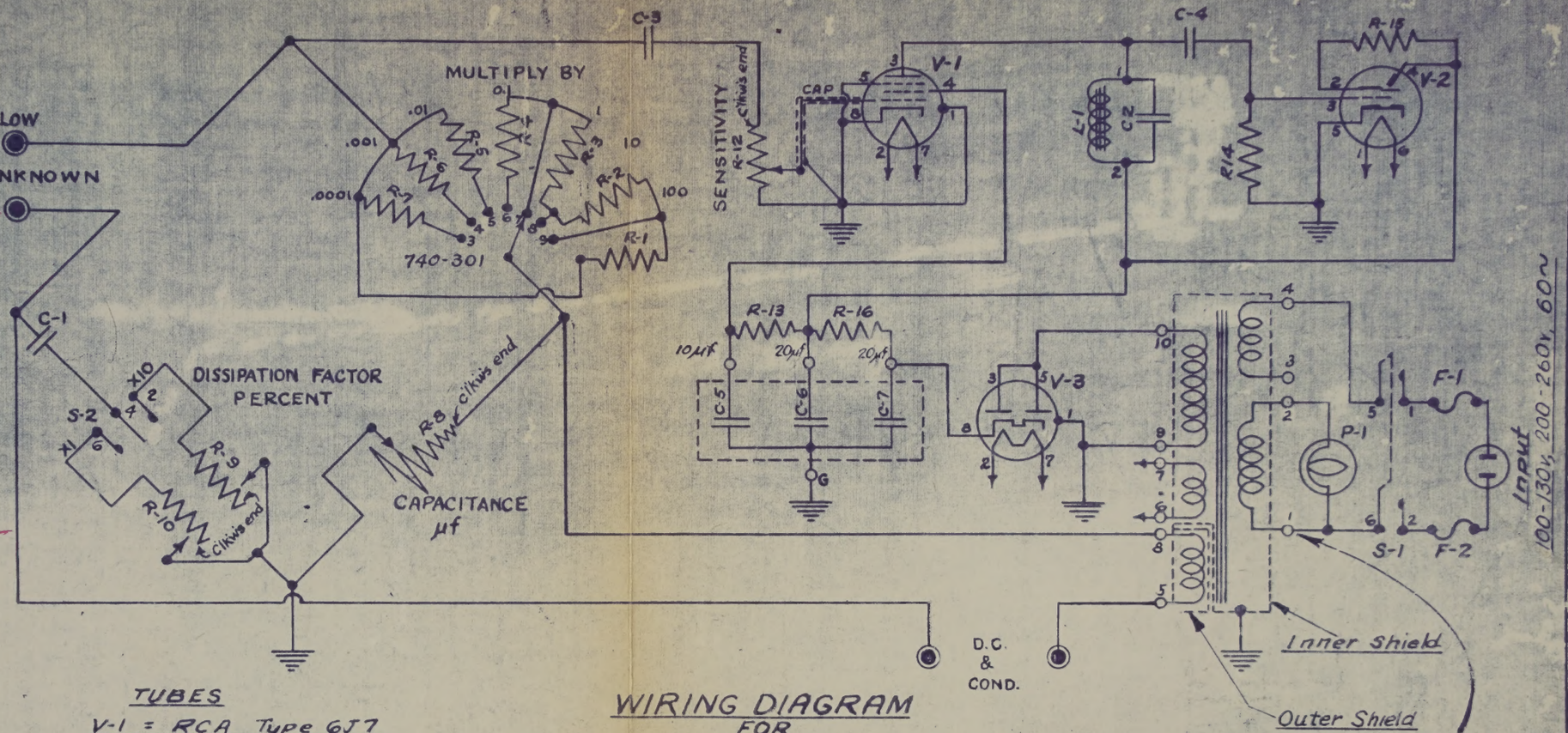
S-2 = S.P.D.T., 139-320

FUSES

F-1 = 0.3amp Slow Blow 3AG GR FUF-1 (115V.)
F-2 = 0.3amp Slow Blow 3AG GR FUF-1

F-1 = 0.15amp Slow Blow 3AG GR FUF-1 (230V.)
F-2 = 0.15amp Slow Blow 3AG GR FUF-1

P-1 = 115V. Pilot



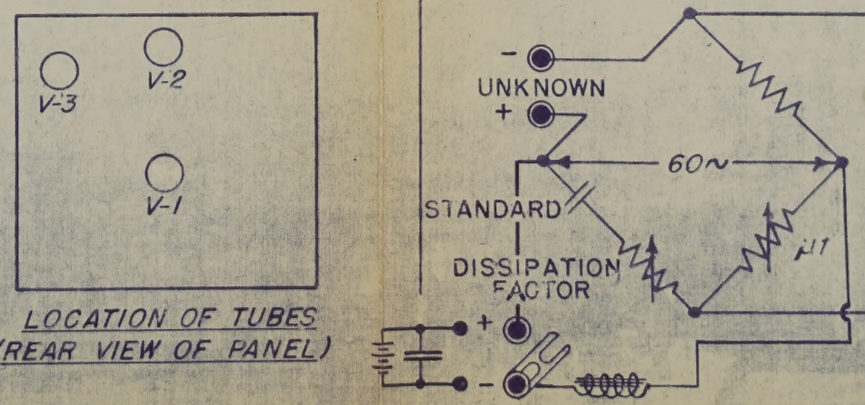
TUBES

V-1 = RCA Type 6J7
V-2 = RCA Type 6E5
V-3 = RCA Type 6X5GT/G

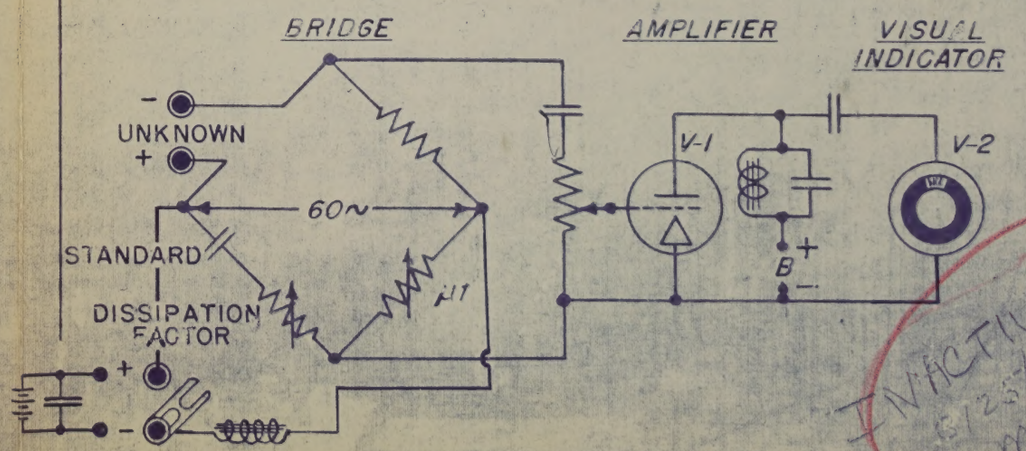
P-1 = 115V Pilot lamp

WIRING DIAGRAM FOR 740-B CAPACITANCE TEST BRIDGE

For 115V. Operation Connect 3 to 3 & 4
For 230V. Operation Connect 2 to 3



LOCATION OF TUBES (REAR VIEW OF PANEL)

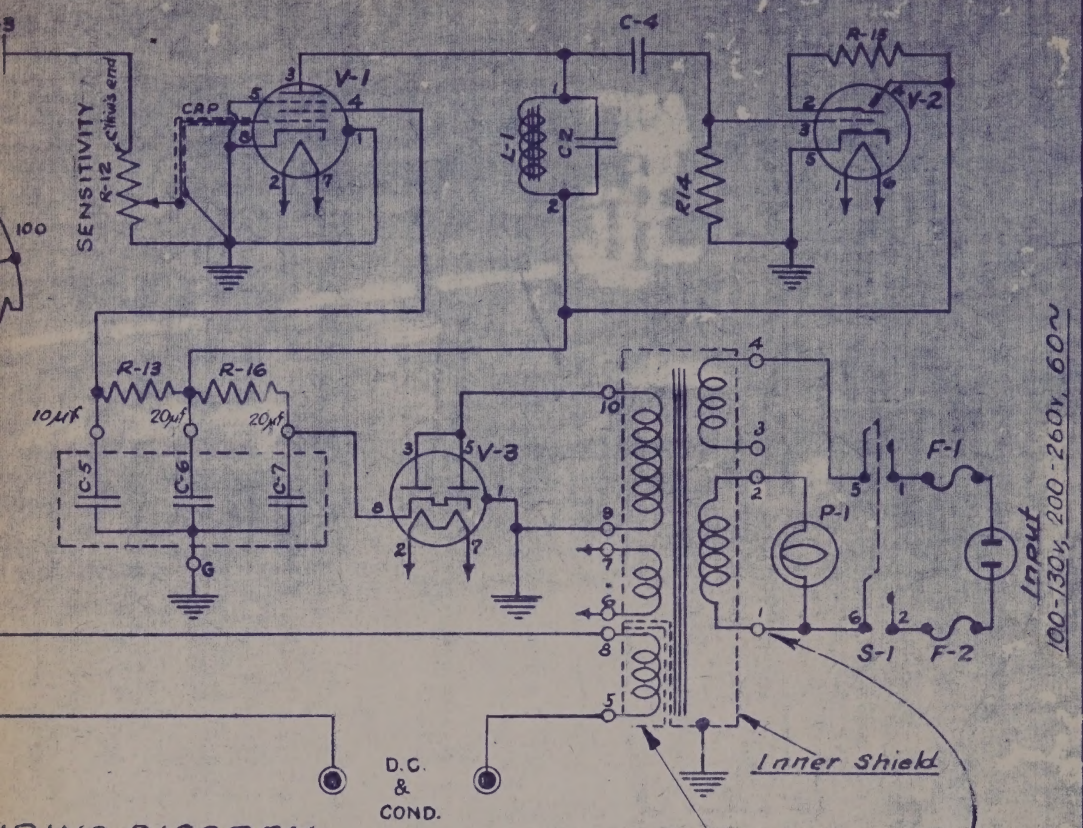


INACTIVE 8/25/43 MEM

740-B CAP. TEST BRIDGE
GENERAL RADIO CO.
CAMBRIDGE, MASS.
DATE 6-9-37 DR. PRC TR. MR. CH. MR.
DWG. NO. 740-5D

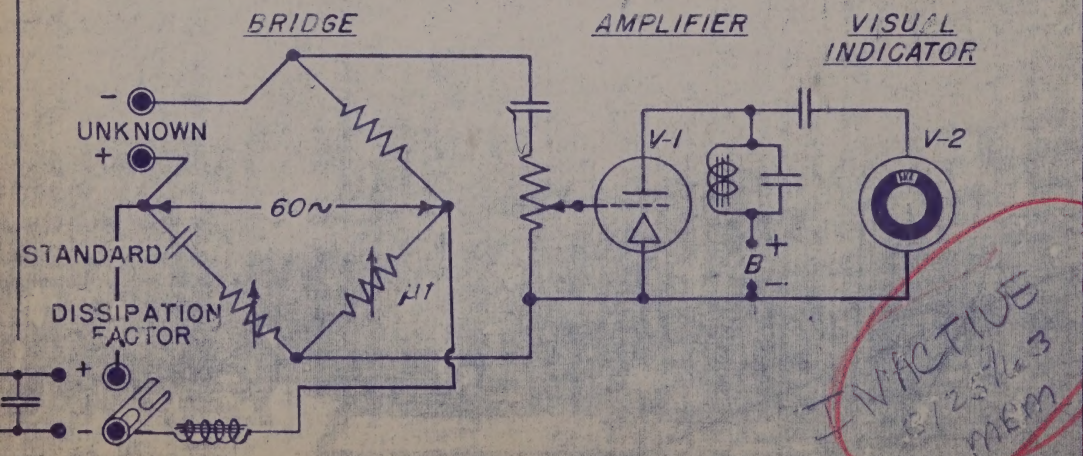
NO.	CHANGE	APP.	DATE
17	C-5 was 2μf, C-6 was 8μf, C-7 was 16μf	MRM	12-27-48
18	COEB-3 2 was COEB-3 3, POSC-7 was 133-253	KCT	6-10-49

DIMENSION TOLERANCES
FRACTIONAL ± .010"
DECIMAL ± .002"
UNLESS OTHERWISE SPECIFIED



WIRING DIAGRAM FOR CAPACITANCE TEST BRIDGE

For 115V Operation Connect 1 to 3 & 4
For 230V Operation Connect 2 to 3

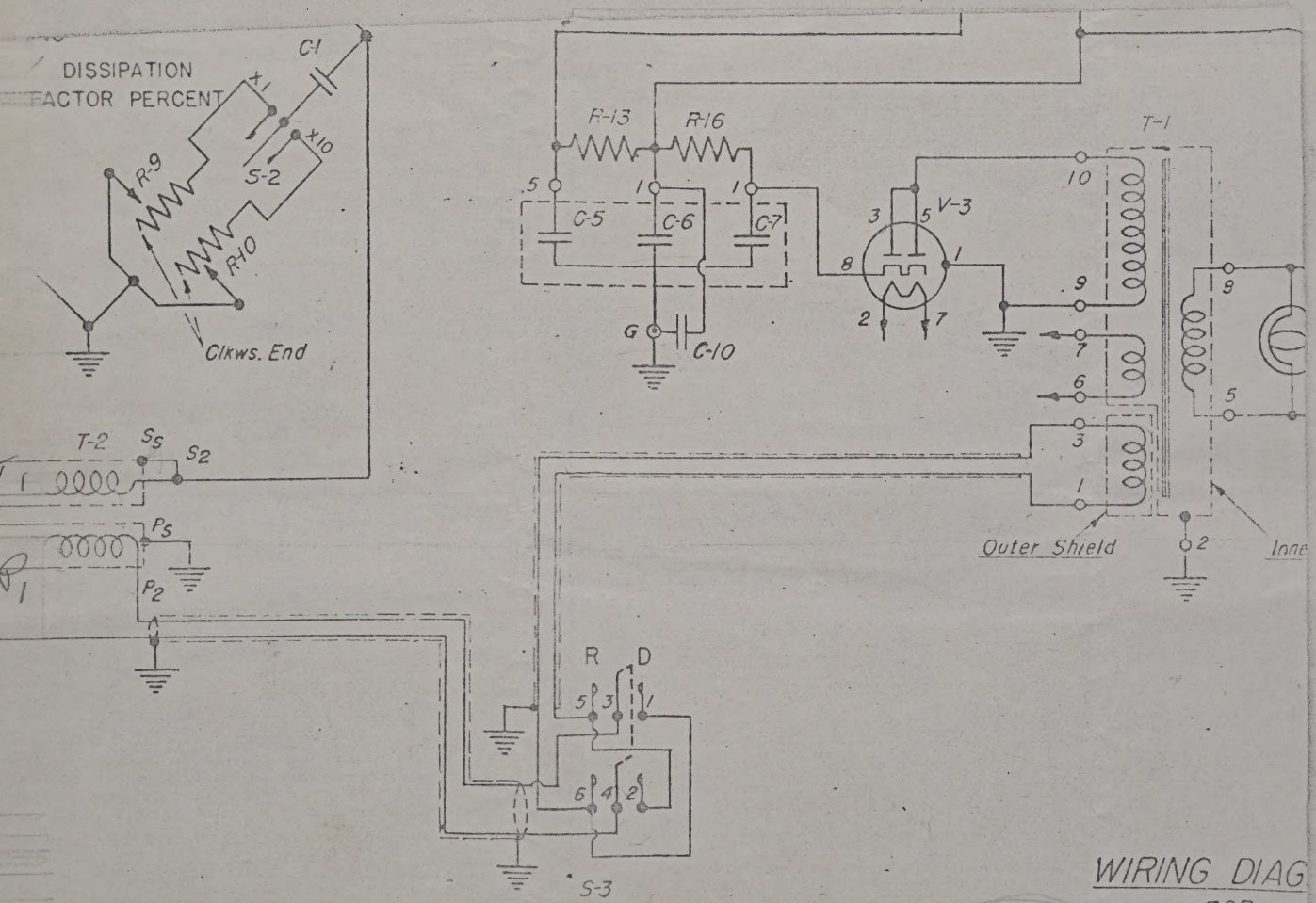


INACTIVE 5/25/43 MRM

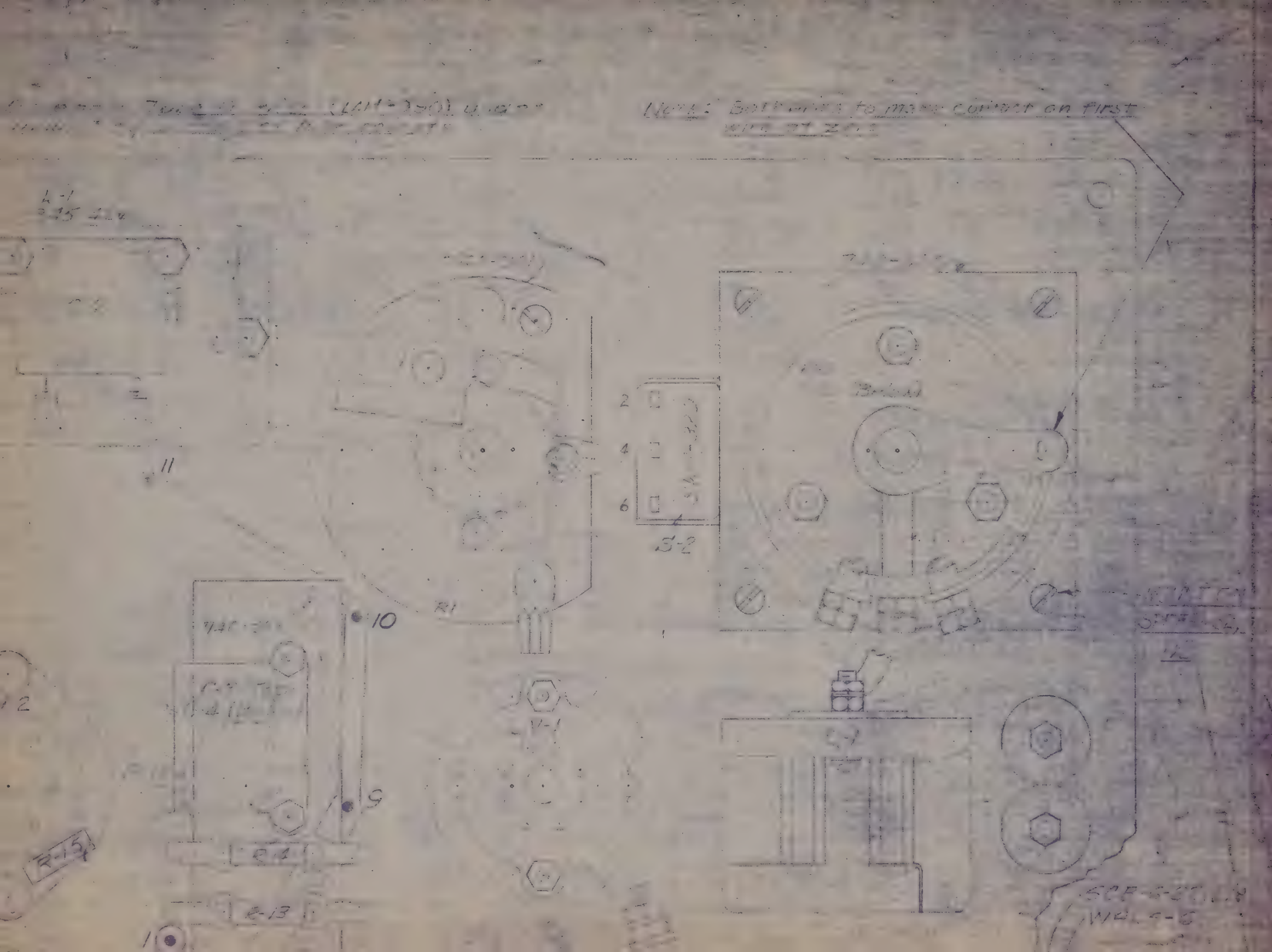
740-B CAP. TEST BRIDGE
GENERAL RADIO CO.
CAMBRIDGE, MASS.
DATE 6-9-37 DR. BRC TR. MRM CH. MRM
DWG. NO. 740-5D

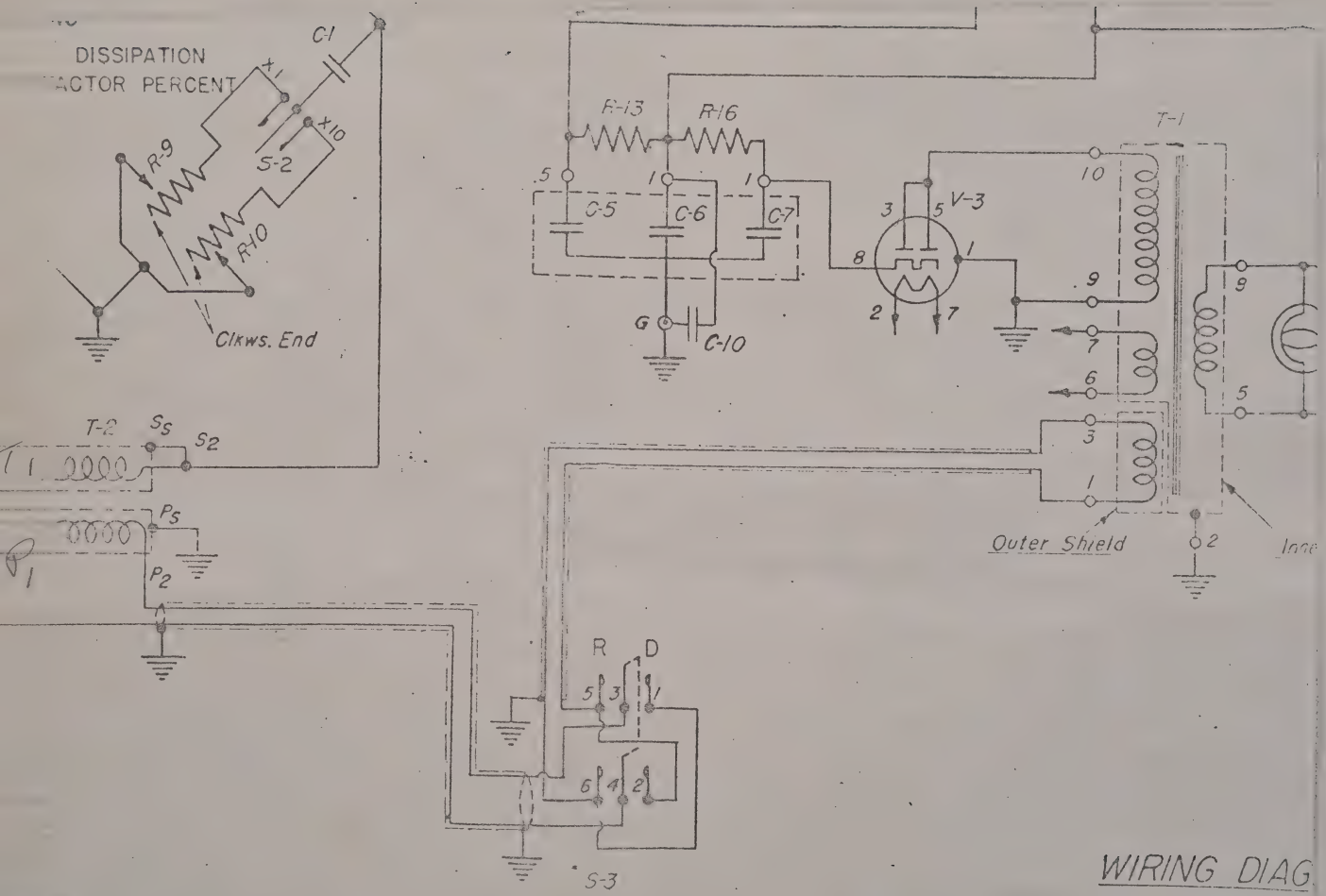
NO.	CHANGE	APP.	DATE	NO.	CHANGE	APP.	DATE
17	C-5 was 2μf. C-6 was 8μf. C7 was 16μf						
18	Coil 3 2 was Coil 3 Pos. 2 was 1 & 3	MRM KGR	2-27-48 6-10-49				

DIMENSION TOLERANCES
FRACTIONAL ± .010"
DECIMAL ± .002"
UNLESS OTHERWISE SPECIFIED

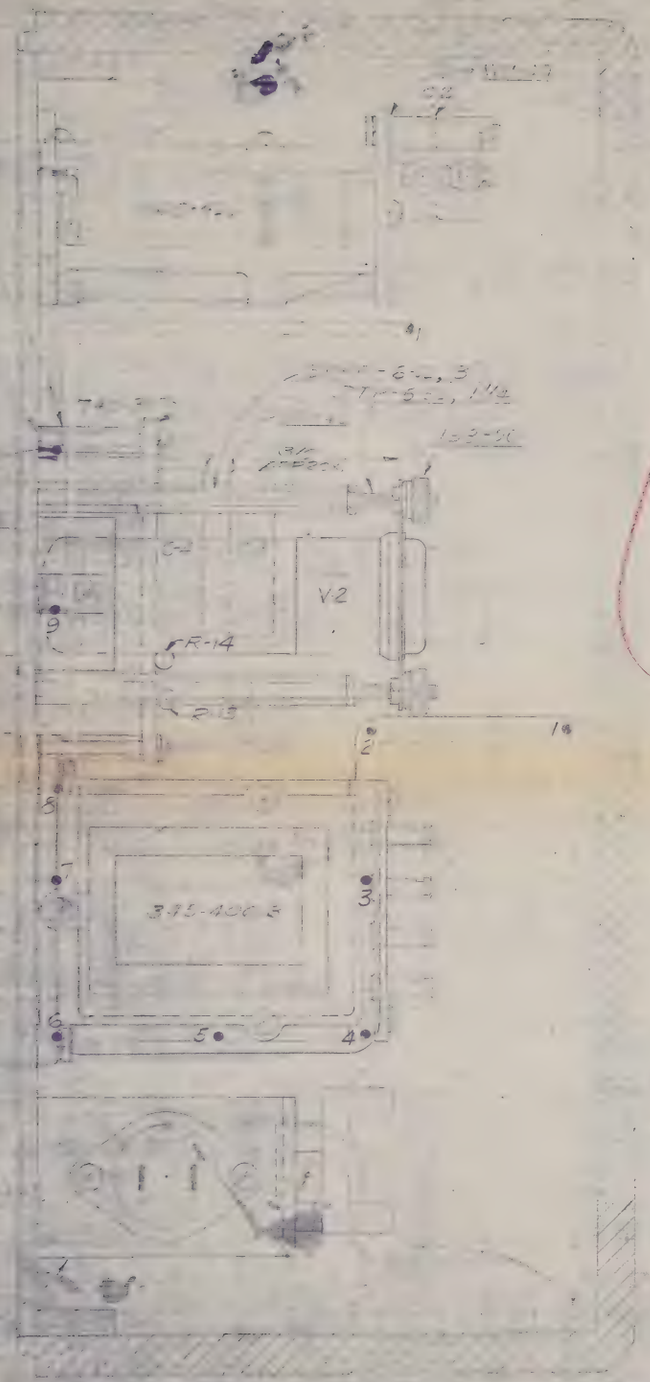


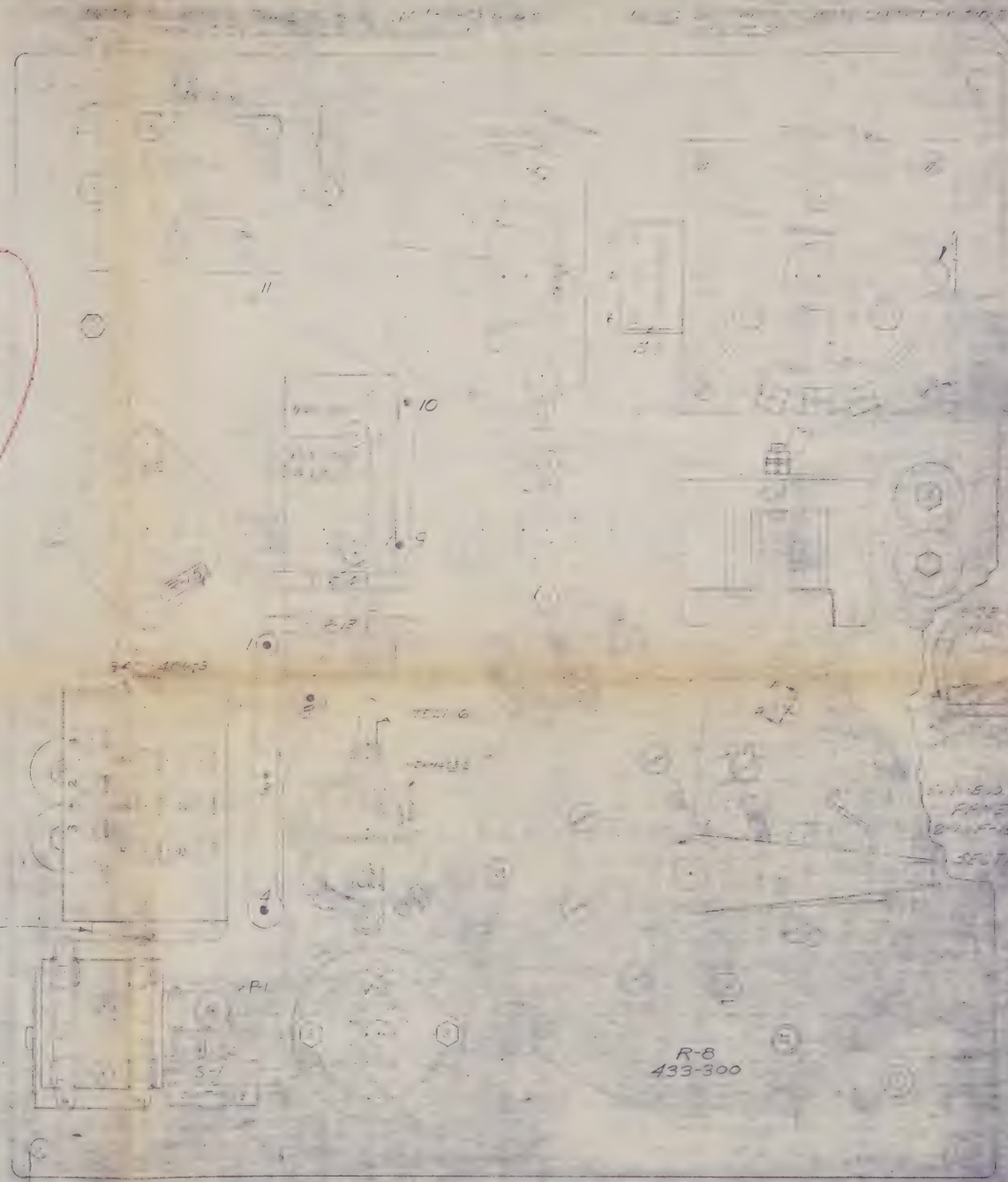
WIRING DIAG
FOR
740-BG CAPACITANC


Bolted
S-2
R1
V-1
S-1
E-4
E-13
R-15
10
9
11
2
1
2
4
6



WIRING DIAG
FOR
740-BG CAPACITANC





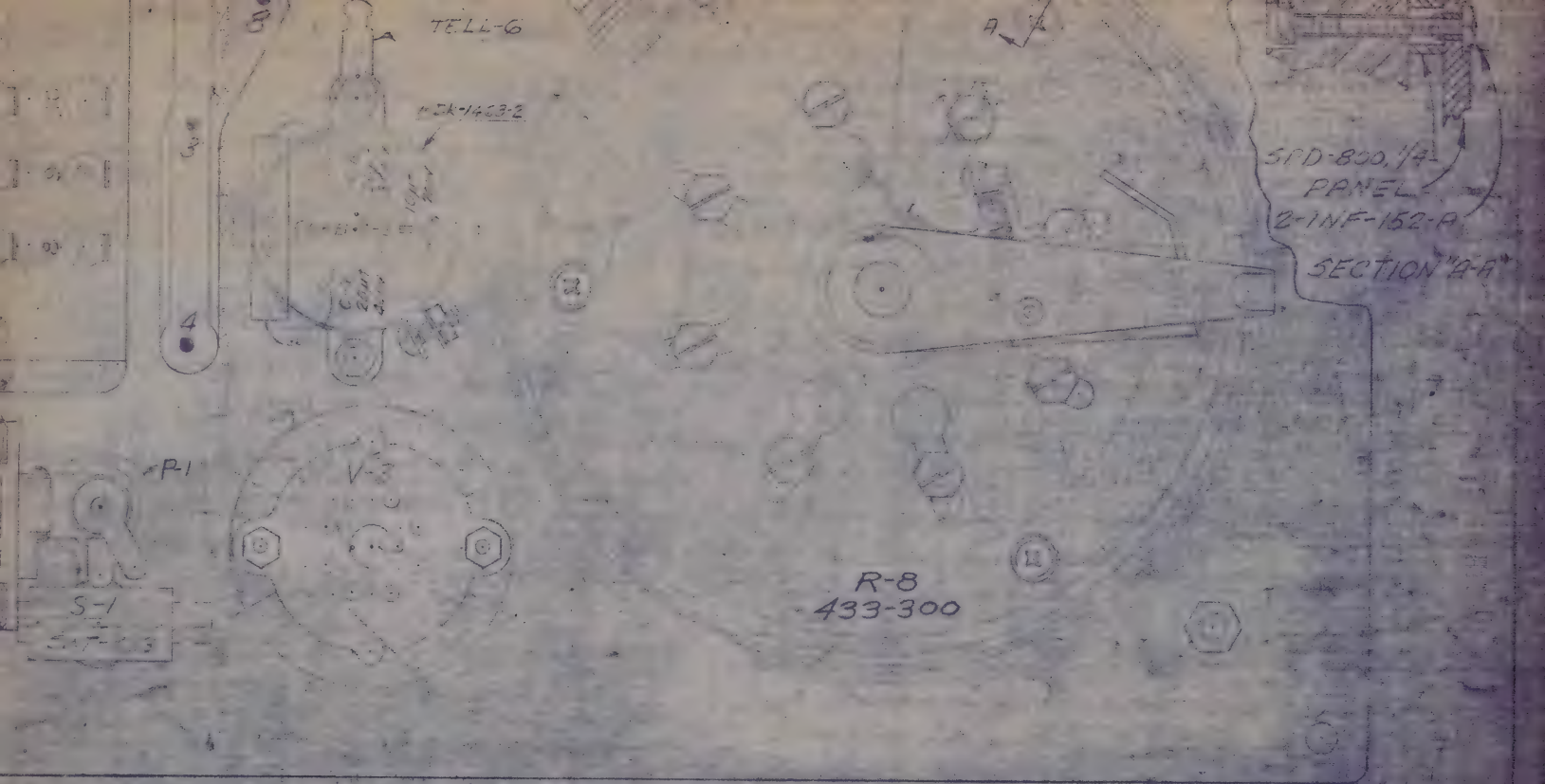
NOTE: POSITION FLAT ON HEX NUTS THAT MOUNT
V1 & V3 AS SHOWN

FRONT VIEW

NO	CHANGE	APP	DATE	NO	CHANGE	APP	DATE
28	[illegible]	[illegible]	[illegible]				
29	[illegible]		[illegible]				
	[illegible]						
	[illegible]						

GENERAL RADIO CO.

740-4D



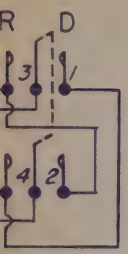
NOTE: POSITION FLAT ON HEX NUTS THAT MOUNT V1 & V3 AS SHOWN

PANEL - REAR (BOTTOM VIEW)

NO	CHANGE	APP	DATE	NO	CHANGE	APP	DATE
	REVISED PER MARKED						
28	RECORD MARK	RCE	2-10-54				
29	TERM. AT C1						
	BEND 90° CLR	RCE	2-25-60				
30	TELL-10 WAS TELF						
	TO TELL-6 WAS						
	TELF-6 ELIT		5-4-0				

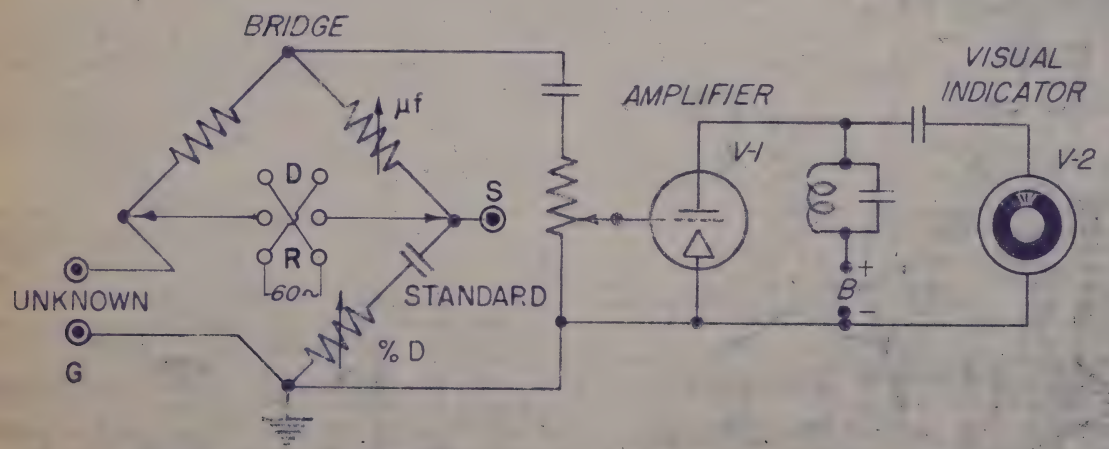
GENERAL RADIO CO.

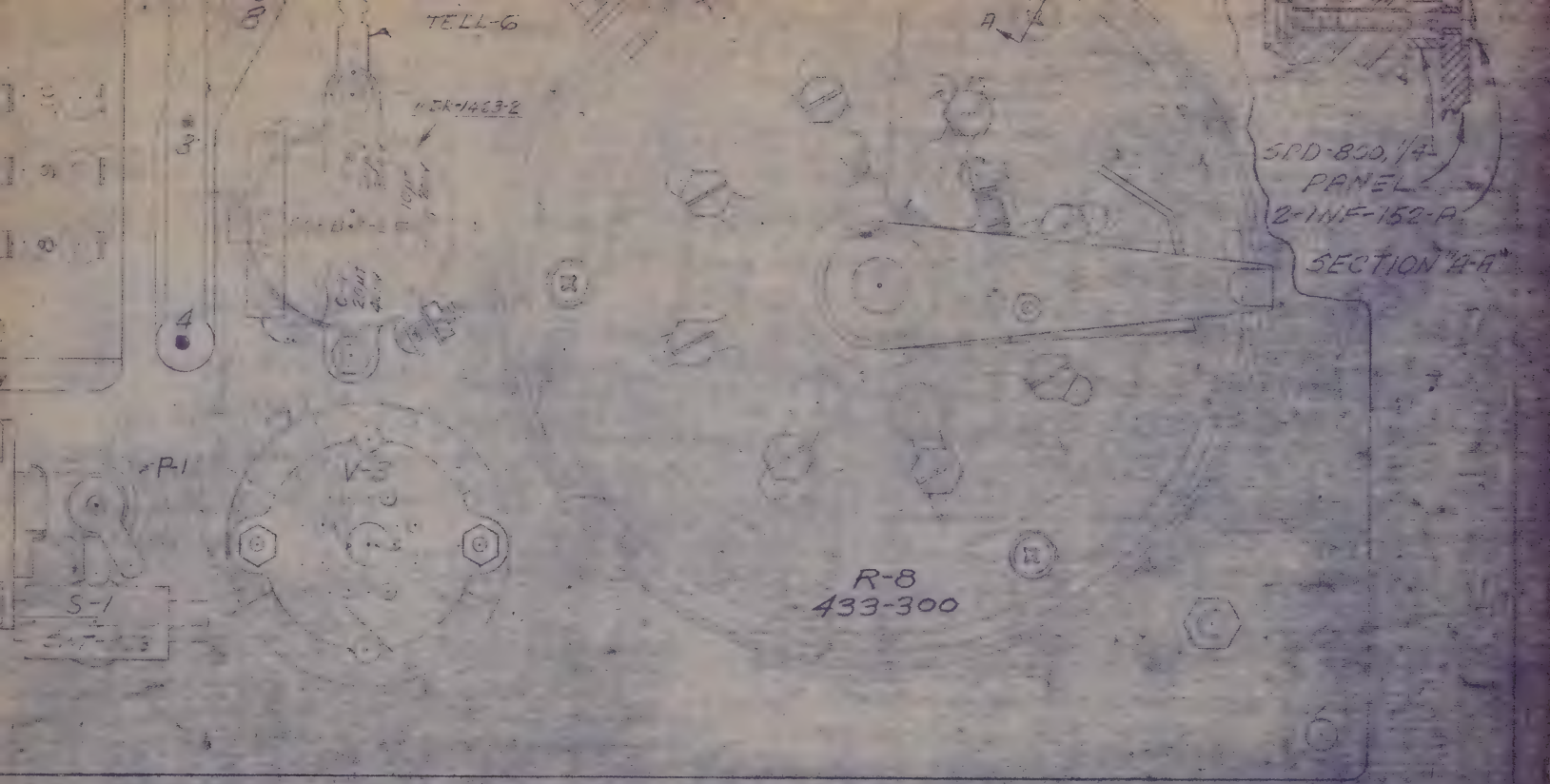
DRAWING NO. 740-4D



6-3

WIRING DIAGRAM
FOR
740-BG CAPACITANCE TEST BRIDGE





NOTE: POSITION FLAT ON HEX NUTS THAT MOUNT V1 & V3 AS SHOWN

PANEL 740-B (BOTTOM VIEW)

NO	CHANGE	APP	DATE	NO	CHANGE	APP	DATE
	REVISED PER TRACE'D						
28	RECORD MKM						
29	TERM. AT C1		2-10-54				
	BEN 90° CLR		2-25-60				
30	TELL-10 WAS TELE						
	V2, TELL-6 WAS						
	TELL-6 EJF		5-1-60				

740-B

GENERAL RADIO

740-4D

8	398-906-2 was 406	JAR	2-2-44	1	Tube Layout Corrected	JAR	6-13-39
9	ICE03 was ICW81, C10 removed	JAR	3-1-44	2	C9 rmvd, L1 was 345-402		
10	0.56 MΩ was 3 MΩ	JAR	5-7-45		C2 was det. in 106	JAR	10-19-39
11	R1 was ± 0.1% (.9960)	JAR	8-27-46	3	C-11, C12 Added	JAR	2-6-40
12	R-9, R10, 3.3 MΩ	JAR	4-29-47	4	C-3 removed	JAR	6-19-40
13	D.C.S. of 1-5-48 Change	JAR	1-6-48	5	-2 added to 345 426	JAR	9-12-41
14	V-3 WAS GX5	JAR	7-16-48	6	C-8 rmvd Mech. connection	JAR	
15	C5 C6 C7 was 2.8 & 16 μf	MRM	12-23-48		of S2 to C2 - C8 rmvd		1-5-49
16	POSC-7 was 139-853	JAR	6-20-49				

740-BG CAPACITANCE METER

DATE: 2-24-39 DR. MRM TR. CH.

DWG. NO. 740-12D

INACTIVE

RESISTORS

R-1 = .9965Ω ± 0.25%
R-2 = 9Ω ± 0.1%
R-3 = 90Ω ± 0.1%
R-4 = 900Ω ± 0.1%
} 740-300

R-5 = 10 KΩ ± 0.1% 602-305
R-6 = 100 KΩ ± 0.1% IRC TYPE WW4 *

R-8 = 11.2K - 11.7 KΩ 433-400
R-9 = 13,120 - 13,380 Ω 214-401
R-10 = 131,200 - 133,800 Ω 371-406

R-12 = 1 MΩ POSC-7
R-13 = 0.56 MΩ IRC TYPE BT-1/2
R-14 = 3.3 MΩ IRC TYPE BT-1/2
R-15 = 3.3 MΩ IRC TYPE BT-1/2
R-16 = 0.1 MΩ IRC TYPE BT-1

CONDENSERS

C-1 = .00988 μf ± 0.25% TYPE 505
C-2 = 0.035 μf DUBILIER TYPE 4

C-4 = .02 μf DUBILIER TYPE 4
C-5 = 10 μf 200 V
C-6 = 20 μf 300 V COE8-3-2
C-7 = 20 μf 400 V

C-11 = 0.0004 μf DUBILIER TYPE 5W
C-12 = 0.004 μf DUBILIER TYPE 1W

MISCELLANEOUS

T-1 = Power Trans. 345-406-3
T-2 = Trans. 740-309

L1 = Choke 345-426-2

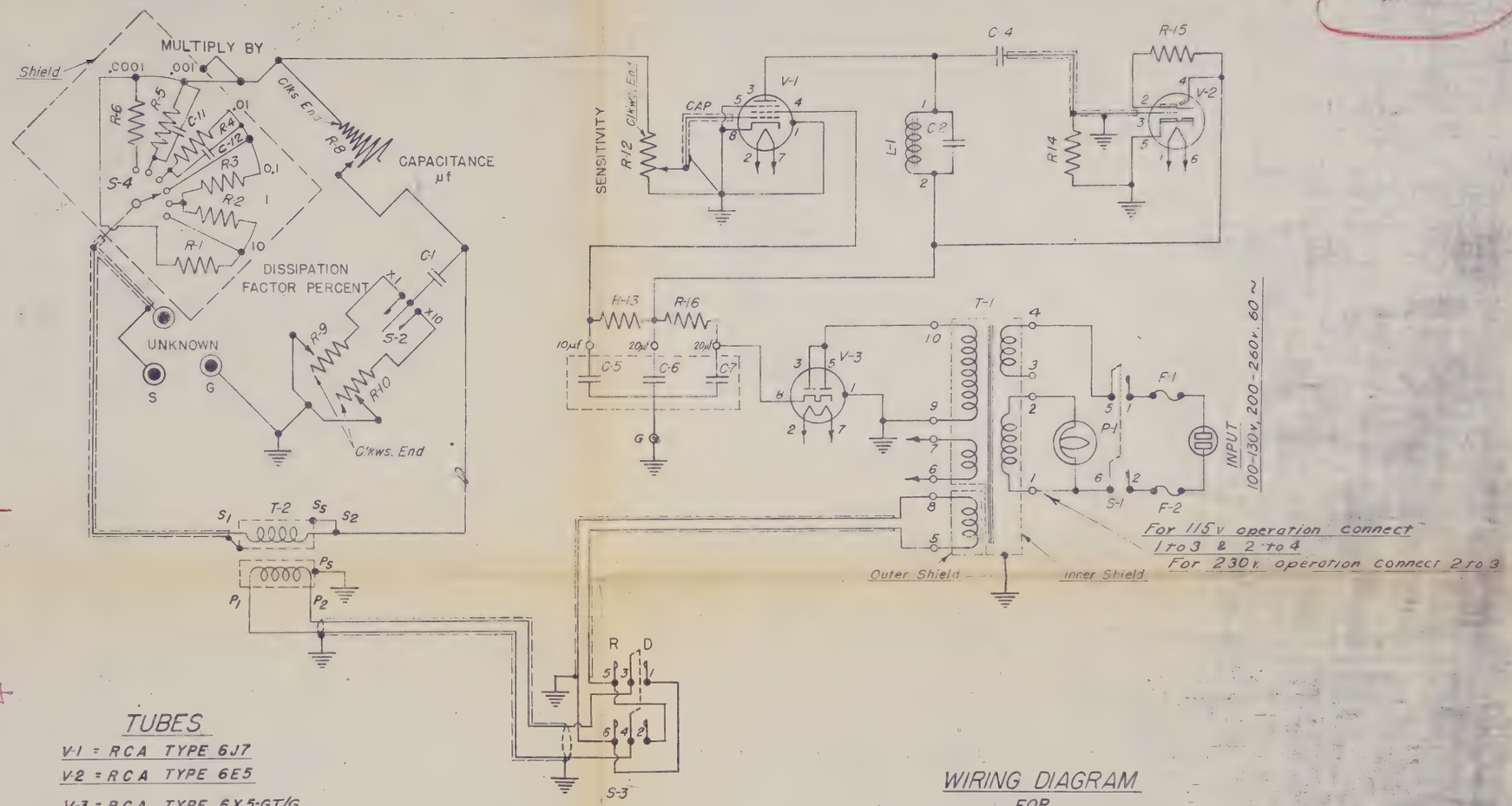
S-1 = D.P.S.T. 139-333
S-2 = D.P.D.T. 139-320
S-3 = D.P.D.T. 139 335
S-4 = 740-201

F-1 = 0.3 amp Slow Blow 3AG GR FUF-1
F-2 = 0.3 amp Slow Blow 3AG GR FUF-1
} 115V

F-1 = 0.15 amp Slow Blow 3AG GR FUF-1
F-2 = 0.15 amp Slow Blow 3AG GR FUF-1
} 230V

P-1 = 115 V Pilot 139-430

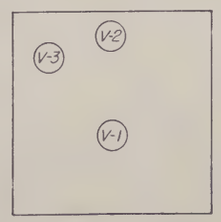
*Wound with Advance Wire



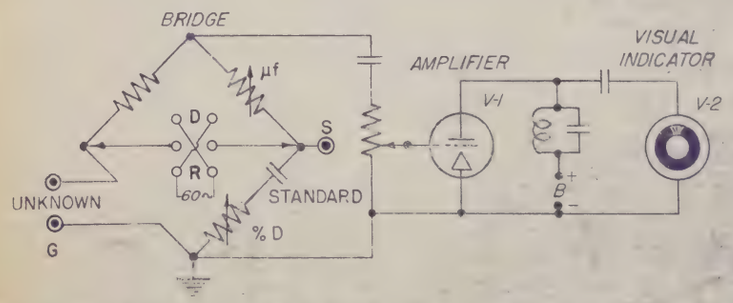
TUBES

V-1 = RCA TYPE 6J7
V-2 = RCA TYPE 6E5
V-3 = RCA TYPE 6X5-GT/G

WIRING DIAGRAM FOR 740-BG CAPACITANCE TEST BRIDGE



LOCATION OF TUBES
REAR VIEW OF PANEL



8	345-406-2 was 406	MR	2-2-44
9	ICEB3 was ICWB1, C10 removed	MR	3-1-44
10	0.56MΩ was 3MΩ	MR	5-7-45
11	R1 was ± 0.1% (.9860)	MR	8-27-46
12	R-14, R-15, 3.3 was 3	MR	4-28-47
13	D.C.S. of 1-5-48 change	MR	1-6-48
14	V-3 was 6X5	MR	7-16-48
15	C5-C6 C7 was 2.8 & 16μf	MRM	12-23-48
16	POSC-7 was 139-853	MR	6-20-49

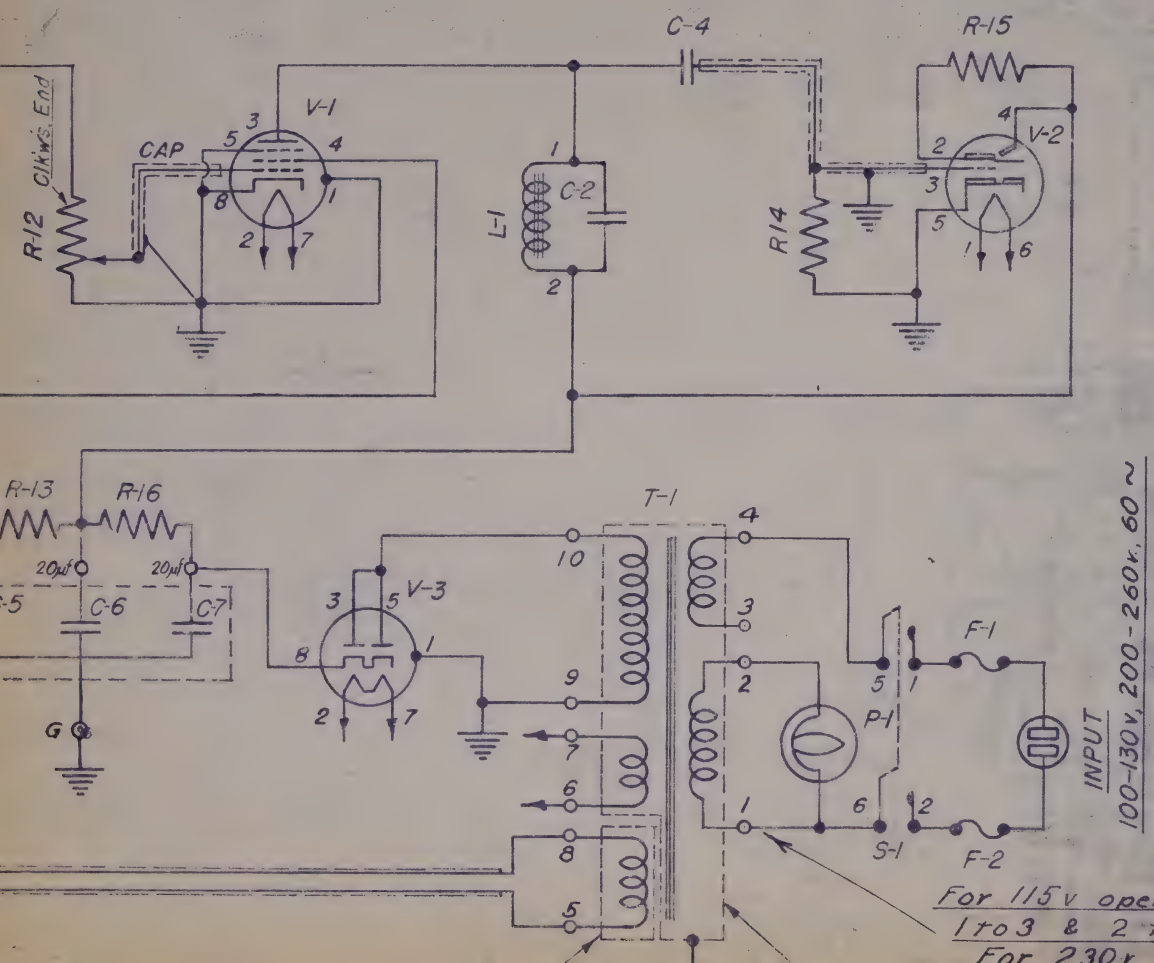
1	Tube Layout Corrected	MR	6-19-39
2	C9 rmvd, L1 was 345-402		
	C2 was det. in lab.	MR	10-19-39
3	C-11, C12 Added	MR	2-6-40
4	C-3 removed	MR	6-19-40
5	-2 added to 345-426	MR	9-12-41
6	C-8 rmvd Mech. connection of S2 to C-2 + C-8 remvd	MR	1-5-42

740-BG CAPACITANCE METER

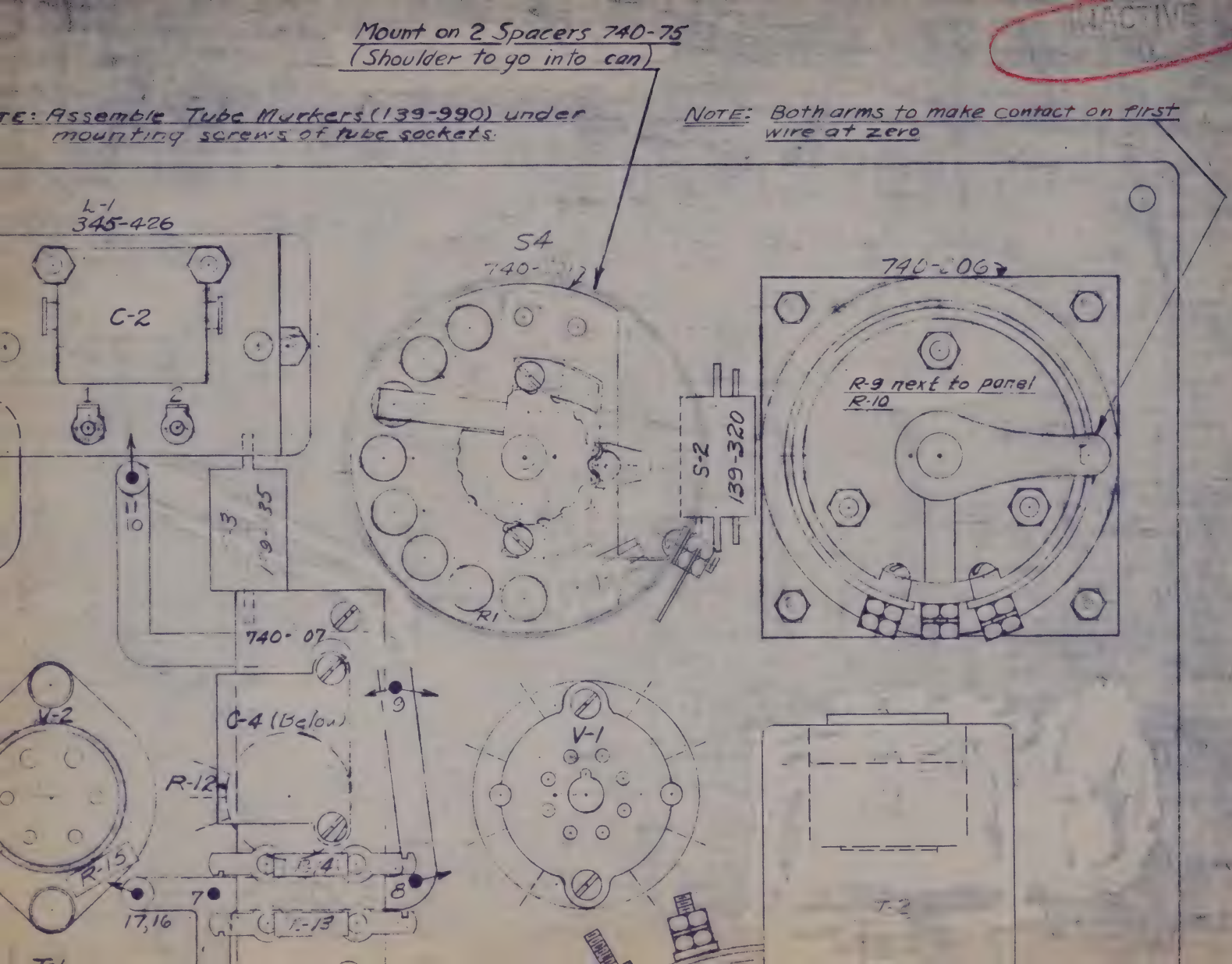
DATE: 2-24-39 DR. MRM TR. CH.

DWG. NO. 740-12D

INACTIVE



INACTIVE


Mount on 2 Spacers 740-75
(Shoulder to go into can)
TE: Assemble Tube Markers (139-990) under mounting screws of tube sockets
NOTE: Both arms to make contact on first wire at zero
L-1
345-426
C-2
1
2
S4
740-
R1
S-2
139-320
740-06
R-9 next to panel
R-10
-3
139-25
740-07
V-2
C-4 (Below)
9
R-12
R-15
R-14
7
8
17,16
R-13
V-1
T-2

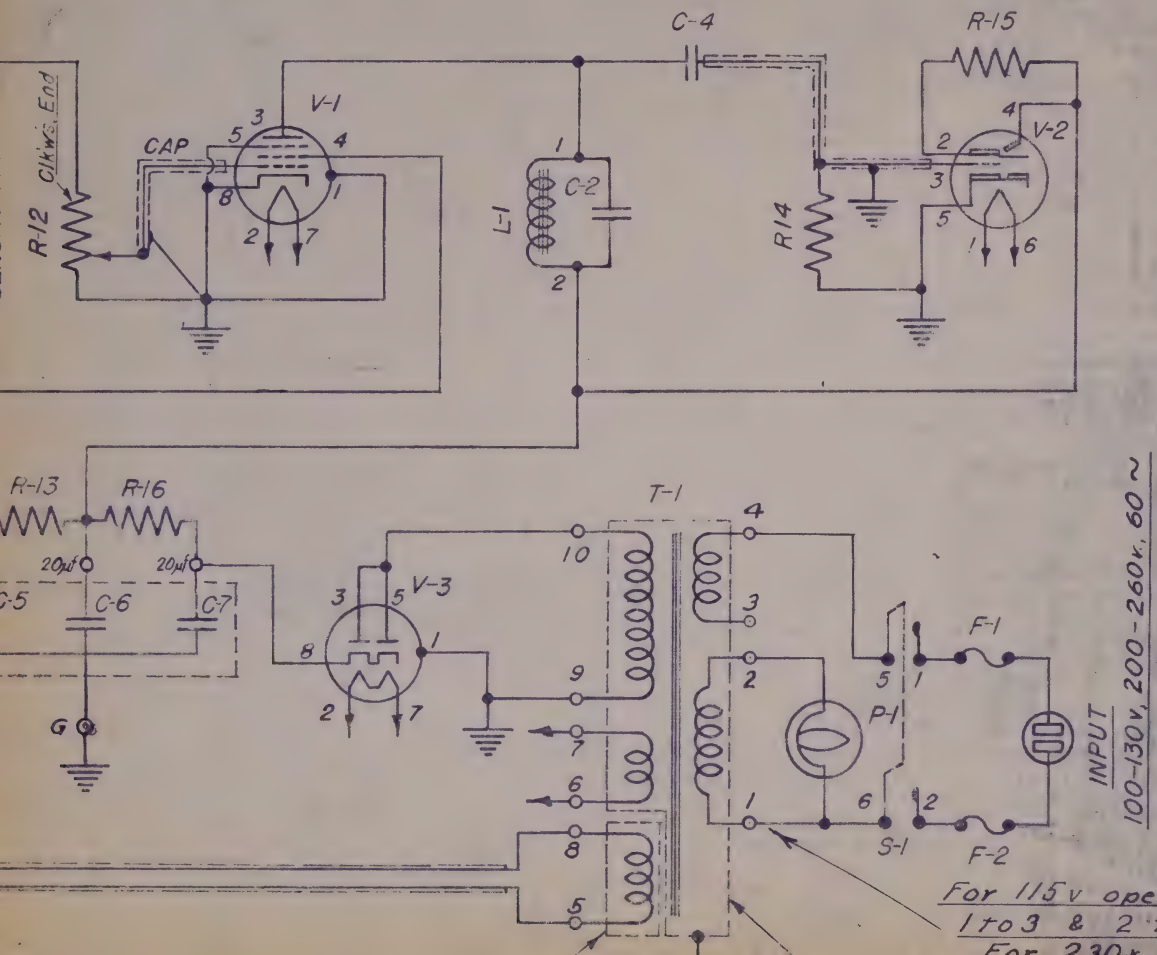
8	345-906-2 was 406		2-2-44	1	Tube Layout Corrected		6-19-39
9	ICEB3 was ICWB1, C10 removed		3-1-44	2	C9 rmvd, L1 was 345-402		
10	0.56 MΩ was 3 MΩ		5-7-45		C2 was det. in lab.		10-19-39
11	R1 was ± 0.1% (.9860)		8-27-46	3	C-11, C12 Added		2-6-40
12	R-14, R-15, 33 was 3		4-28-47	4	C-3 removed		6-19-40
13	D.C.S. of 1-5-48 change		1-6-48	5	-2 added to 345-426		9-12-41
14	V-3 was 6X5		7-16-48	6	C-8 rmvd Mech. connection		
15	C5-C6 C1 was 2.8 & 16 μf	MRM	12-23-48		of S2 to C2 + C6 removed		1-5-42
16	POSC-7 was 139-853		6-20-49				

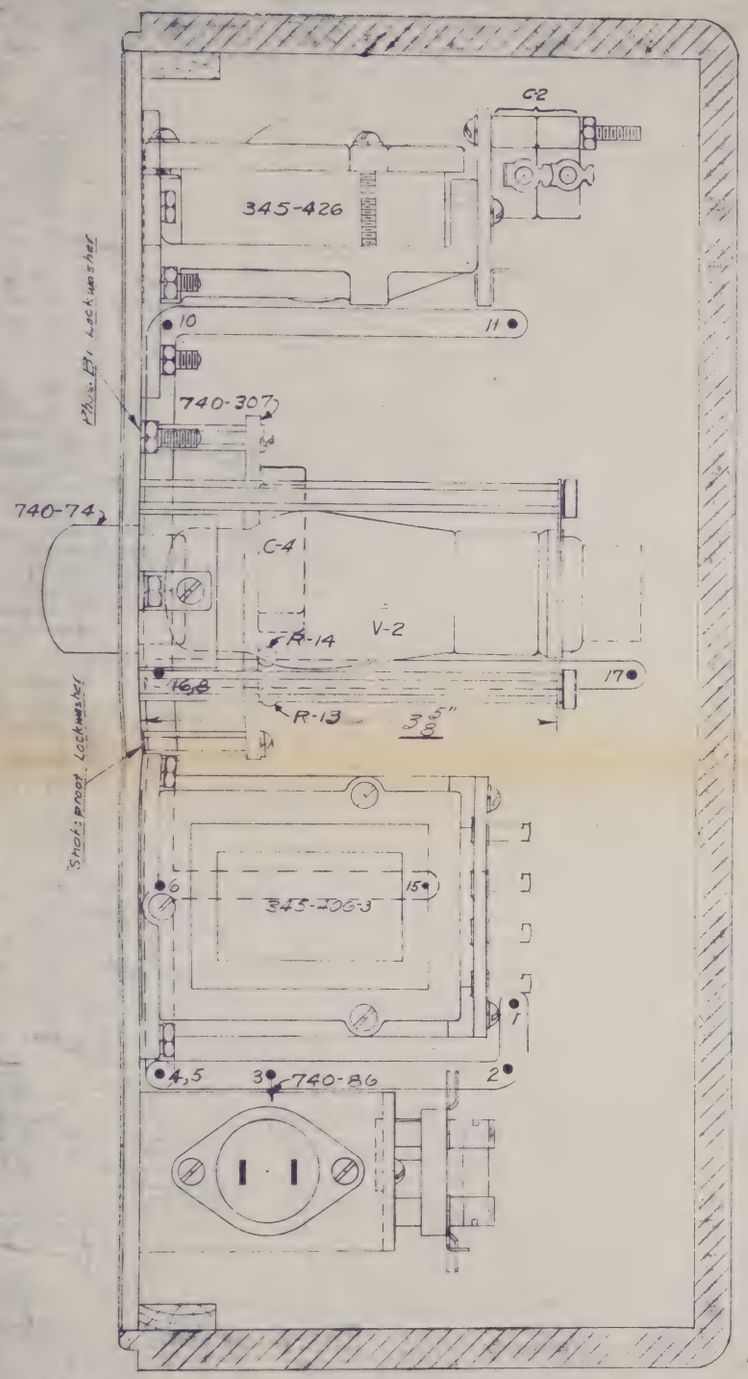
740-BG CAPACITANCE METER

DATE: 2-24-39 DR. MRM TR. CH.

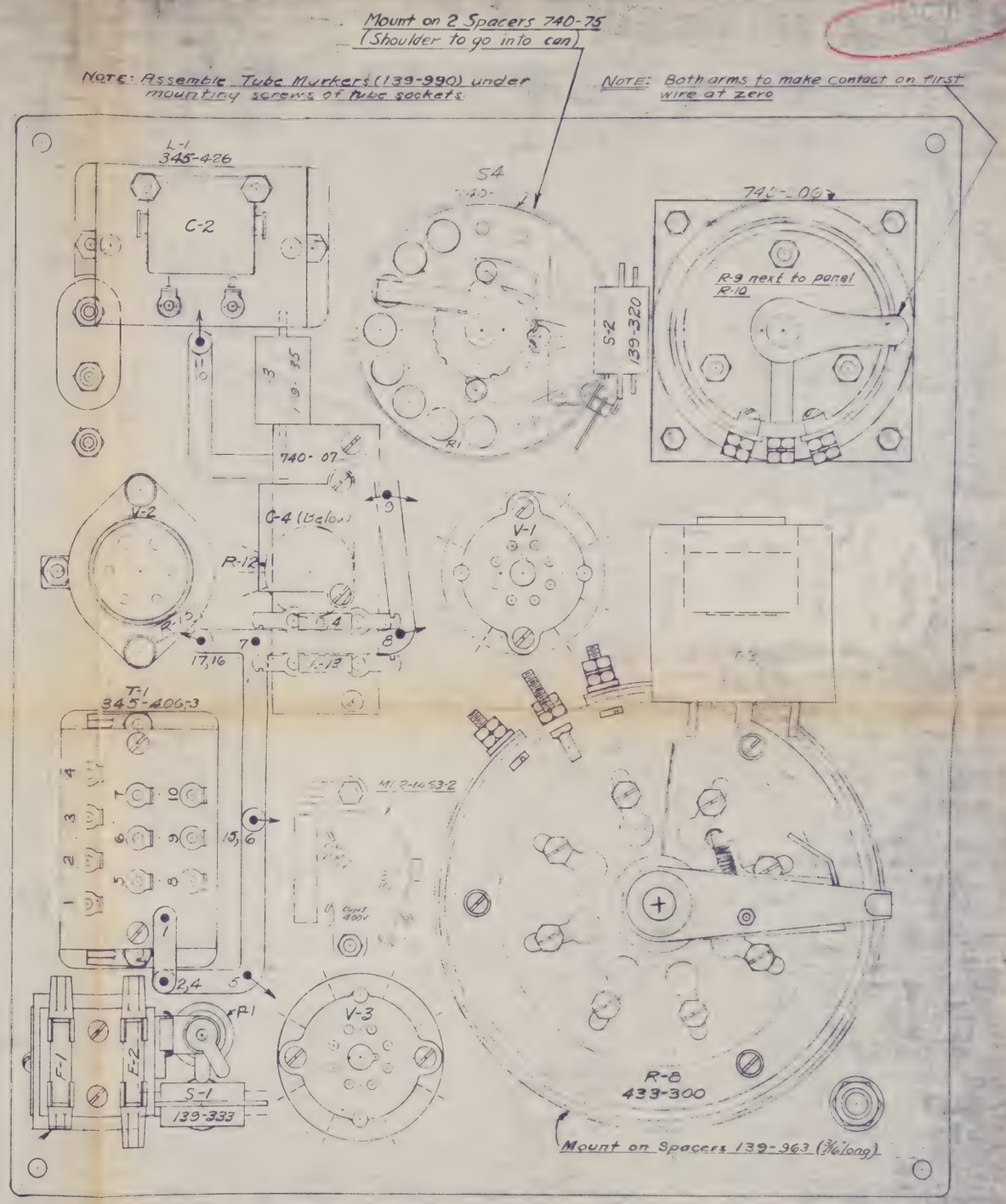
DWG. NO. 740-12D

INACTIVE





REAR VIEW



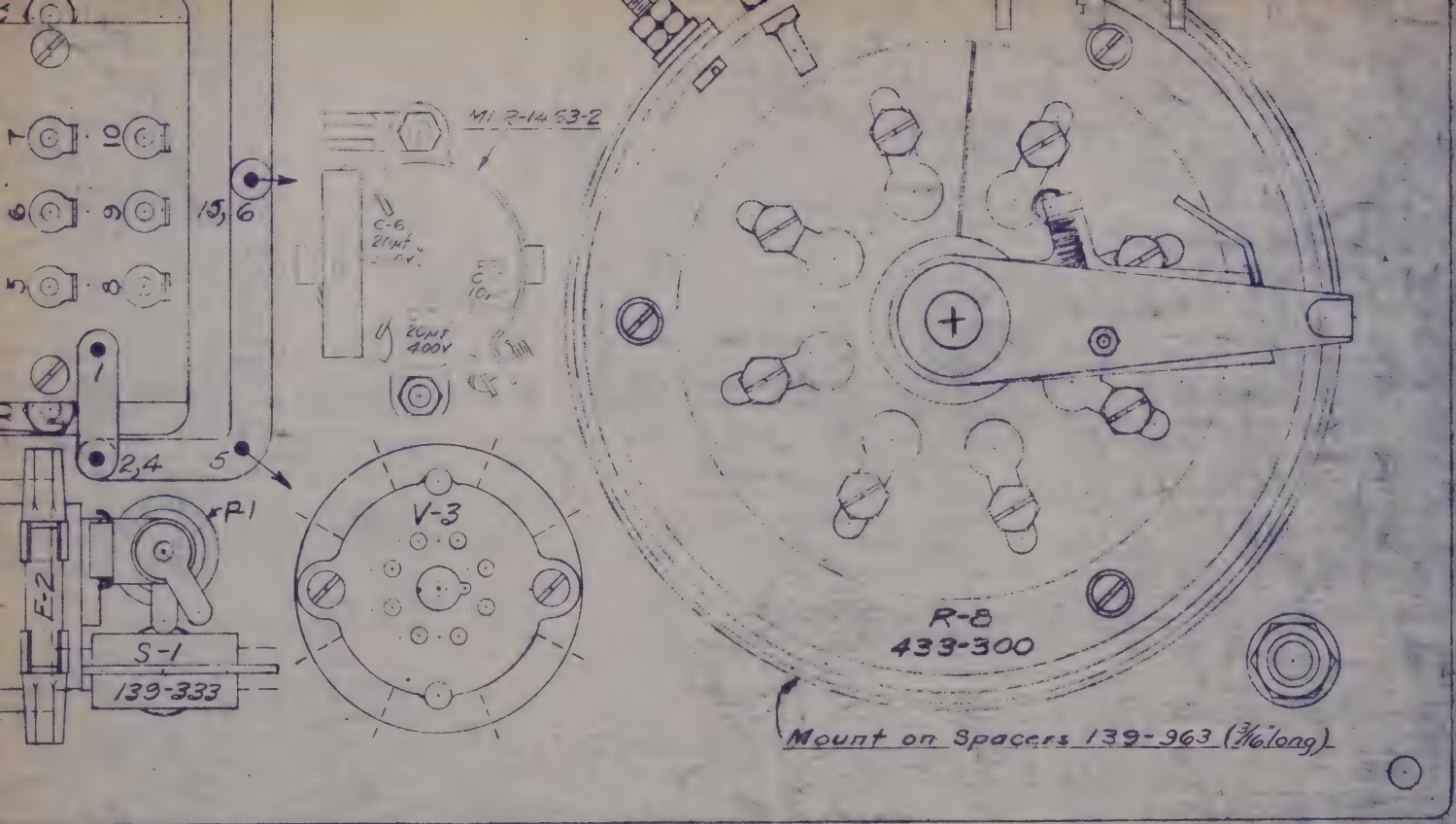
Bend up this terminal.

PANEL LAYOUT (BOTTOM VIEW)

740-BG CAPACITANCE TEST BRIDGE

NO.	CHANGE	APR	DATE	NO.	CHANGE	APR	DATE
1	345-426 was 402, C9 removed		10-19-39	9	[illegible]		[illegible]
2	Unknown term. mod. removed		[illegible]	9	[illegible]		[illegible]
3	[illegible]		[illegible]	10	[illegible]		1-7-[illegible]
4	[illegible]		[illegible]	11	313-406 was [illegible]		5-[illegible]
5	139-963 was -316		10-29-41	12	[illegible]		
6	[illegible]		[illegible]	13	DWG. SIZE CHGD. TO [illegible]	MRM	12-28-42
7	[illegible]		[illegible]				

740-BG CAP. TEST BRIDGE
GENERAL RADIO CO.
CAMBRIDGE, MASS.
DATE DR. FC TR. SH.
DWG. NO. 740-11D



PANEL LAYOUT (BOTTOM VIEW)

740-BG CAPACITANCE TEST BRIDGE

NO.	CHANGE	APR	DATE	NO.	CHANGE	APR	DATE
1	345-426 was 402, C9 removed		10-19-39	8	C-10 removed		
					1CE33 was 139-214		2-2-44
2	Unknown term. mvd + rearranged		1-2-40	9	Mount Spacers Note 900		3-5-45
3	[illegible]		2-1-40	10	C5, C6, C7 MTG. RING CHGD.	MRM	1-7-46
4	[illegible]			11	345-406 was -2		5-7-48
5	139-963 was -516		10-29-41	12	C-5, 6 & 7 COND. & MTG.		
6	C8 [illegible] 57 was 139-335		1-5-41		RING SIZE CHGD. 57A 15 MIN	MRM	12-28-49
7	345-406-2 was 406		2-[illegible]-44				

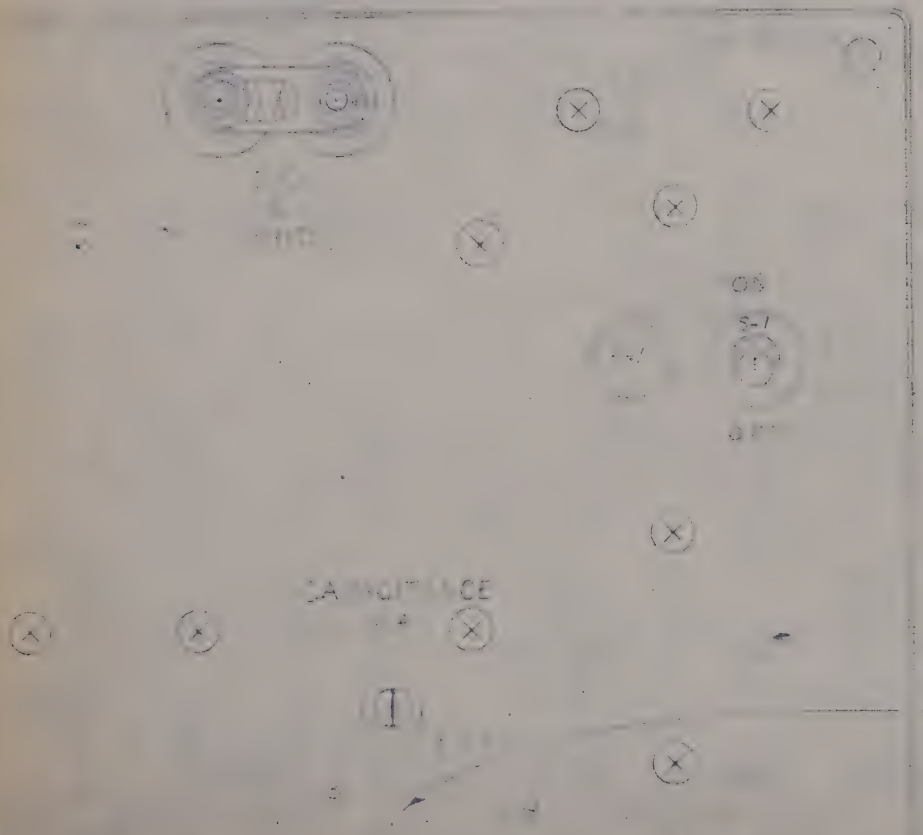
740-BG CAP. TEST BRIDGE

GENERAL RADIO CO.

CAMBRIDGE, MASS.

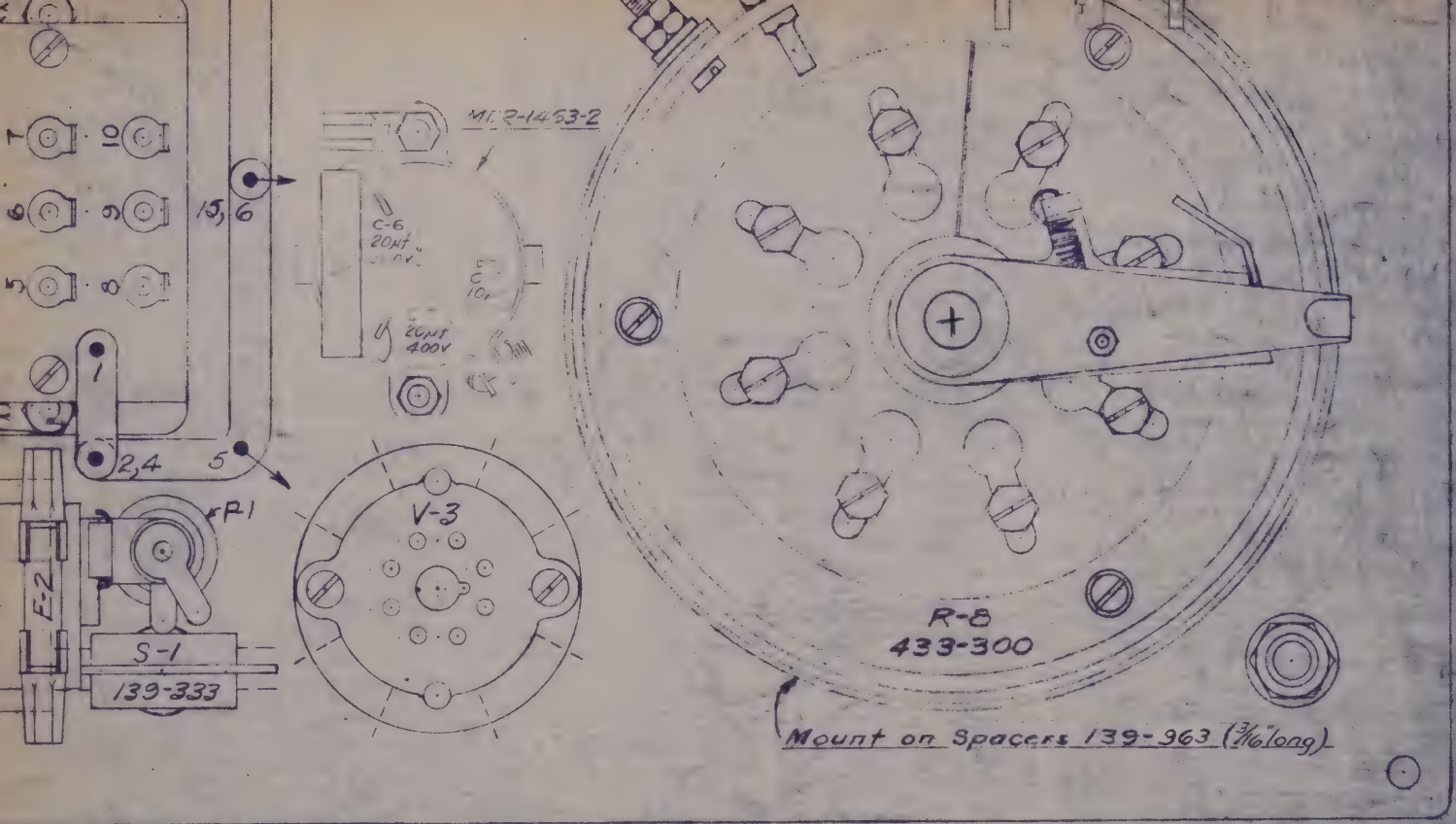
DATE [illegible] DR. [illegible] TR. [illegible]

DWG. NO. 740-11D



WAVE-584 UNDER
INDICATOR ZERO-SYB

434-65

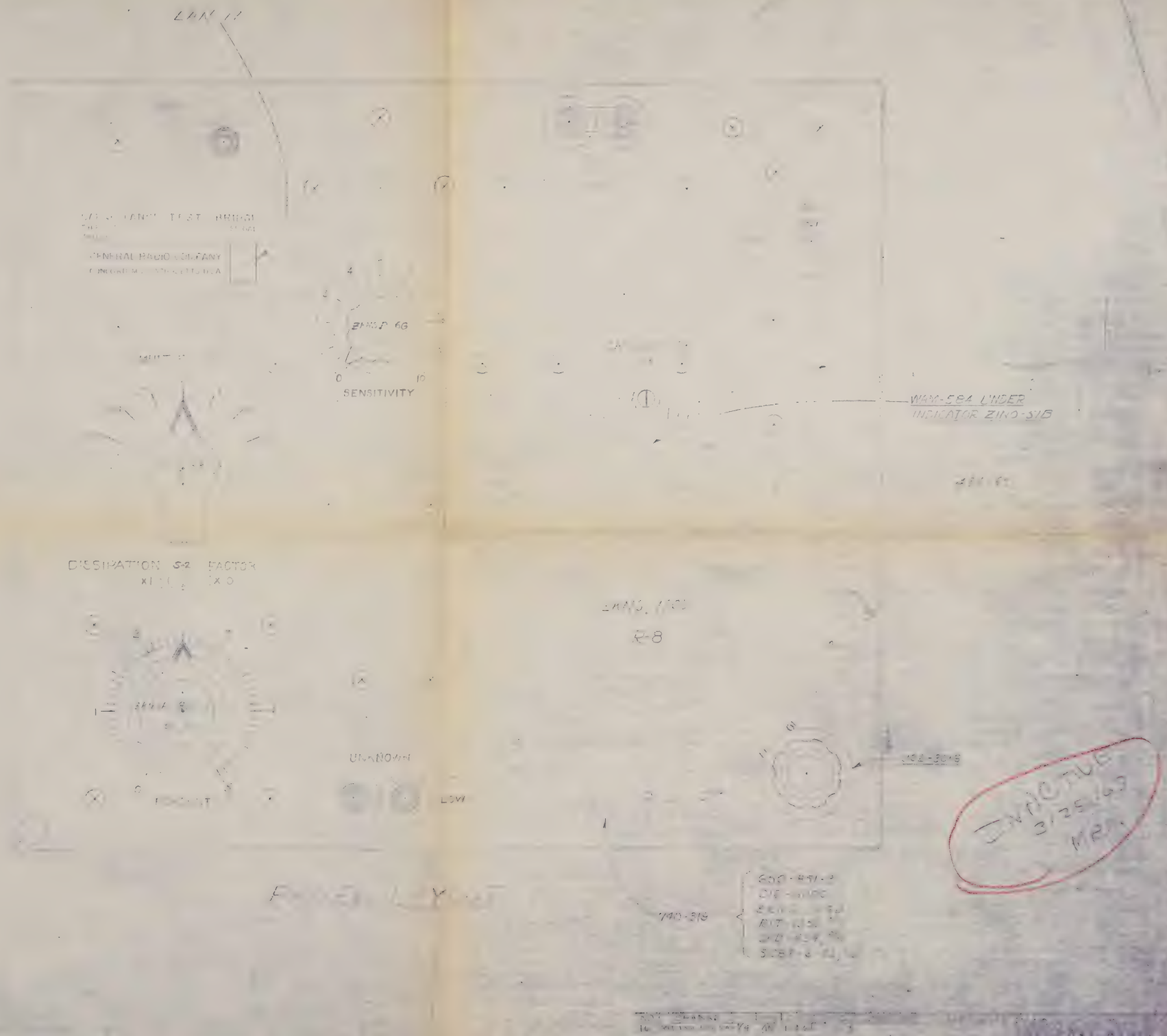


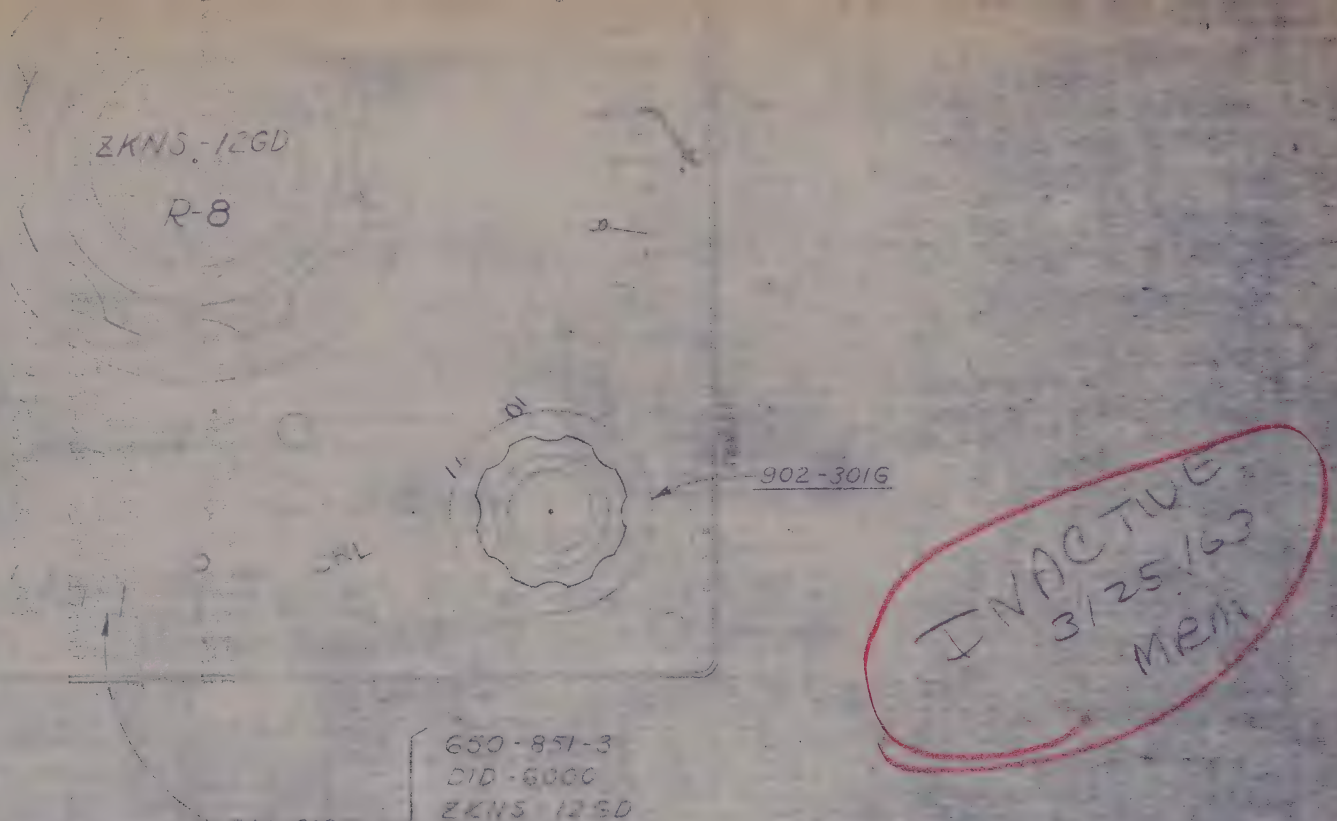
PANEL LAYOUT (BOTTOM VIEW)

740-BG CAPACITANCE TEST BRIDGE

NO.	CHANGE	APR	DATE	NO.	CHANGE	APR	DATE
1	345-426 was 402, C9 removed		10-19-39	8	C-10 removed		
					10 EB3 was 139-214		2-2-49
2	Unknown term. mud. rearranged		1-2-40	9	Mount Spacer Note Add		3-5-45
3	Note on C-1 Bert Add		2-6-40	10	C5,C6,C7 MTG. RING CHGD.	MRM	11-7-46
4	3 [illegible]			11	345-406 3 WIRS-2		5-73
5	139-963 was -516		10-29-41	12	C-5,-6 & 7 COND. & NTG		
6	C8 removed, 57 was 139-335		1-5-41		RING SIZE CHGD. 5/8 to 15 Min	MRM	12-27-49
7	46 406 2 was 406		2-[illegible]-44				

740-BG CAP. TEST BRIDGE
GENERAL RADIO CO.
CAMBRIDGE, MASS.
DATE [illegible] DR. [illegible] TR. [illegible]
DWG. NO. 740-11D

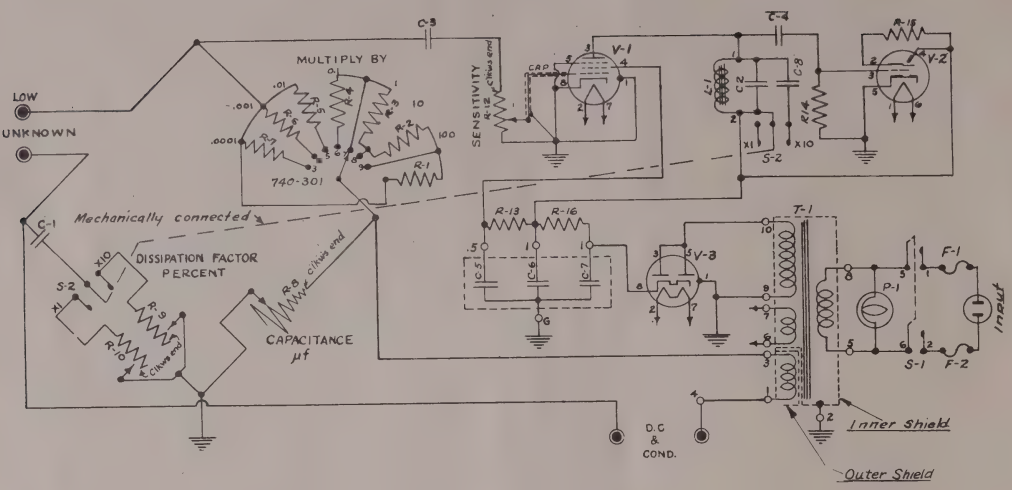

GENERAL RADIO COMPANY
SENSITIVITY
DISSIPATION FACTOR
UNKNOWN
LOW
R-8
740-3D



NO	CHANGE					
16	RIT-1251, 1/32 was 1/4	MR	1-9-61			

GENERAL RADIO CO.
CAMBRIDGE, MASS.

740-3D



RESISTORS

R-1 = .9965
R-2 = 9 Ω
R-3 = 90 Ω
R-4 = 900 Ω
R-5 = 10 kΩ
R-6 = 100 kΩ
R-7 = 1 MΩ
R-8 = 11.2 k - 11.7 kΩ
R-9 = 13,120 - 13,380 Ω
R-10 = 1312 - 1338 Ω
R-12 = 1 MΩ
R-13 = 3 MΩ
R-14 = 3 MΩ
R-15 = 3 MΩ
R-16 = 0.1 MΩ

TUBES

V-1 = RCA Type 6J7
V-2 = RCA Type 6E5
V-3 = RCA Type 6X5

CONDENSERS

C-1 = .09975 μf
C-2 = 0.035 μf
C-3 = .02 μf
C-4 = .02 μf
C-5 = 0.5 μf
C-6 = 1 μf
C-7 = 1 μf
C-8 = Det. in Lab.

MISCELLANEOUS

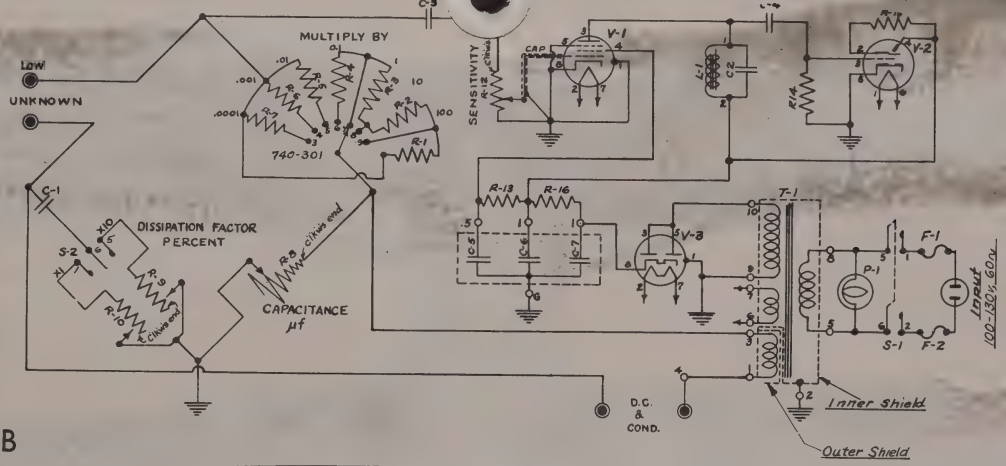
T-1 = Power Trans., 345-406

L-1 = Choke, 345-426

S-1 = D.P.S.T., 139-333
S-2 = D.P.D.T., 139-335

F-1 = 2 amp. Type 8AG (or 7AG)
F-2 = 2 amp. Type 8AG (or 7AG)

P-1 = 115-volt Pilot



TYPE 740-B

PARTS LIST

RESISTORS

R-1 = .9965 Ω
R-2 = 9 Ω
R-3 = 90 Ω
R-4 = 900 Ω
R-5 = 10 kΩ
R-6 = 100 kΩ
R-7 = 1 MΩ
R-8 = 11.2 k - 11.7 kΩ
R-9 = 13,120 - 13,380 Ω
R-10 = 1312 - 1338 Ω
R-12 = 1 MΩ
R-13 = 3 MΩ
R-14 = 3 MΩ
R-15 = 3 MΩ
R-16 = 0.1 MΩ

TUBES

V-1 = RCA Type 6J7
V-2 = RCA Type 6E5
V-3 = RCA Type 6X5

CONDENSERS

C-1 = .09975 μf
C-2 = 0.035 μf
C-3 = .02 μf
C-4 = .02 μf
C-5 = 0.5 μf
C-6 = 1 μf
C-7 = 1 μf

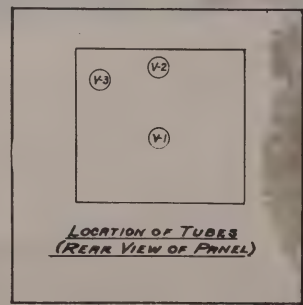
MISCELLANEOUS

T-1 = Power Trans., 345-406
L-1 = Choke, 345-426

S-1 = D.P.S.T., 139-333
S-2 = D.P.D.T., 139-320

F-1 = 2 amp. Type 8AG (or 7AG)
F-2 = 2 amp. Type 8AG (or 7AG)

P-1 = 115-volt Pilot



LOCATION OF TUBES
(REAR VIEW OF PANEL)

TYPE 740-BG CAPACITANCE TEST BRIDGE

The Type 740-BG Capacitance Test Bridge is a 60-cycle bridge for the measurement of capacitance and power factor. The circuit is shown schematically below. The null indicator consists of a tuned amplifier and an electron-ray tube.

RANGE AND ACCURACY

Capacitance Range: 5 μμf to 110 μf.

Capacitance Accuracy: Within ±1% over the main decade (1 to 10) of the capacitance dial for all multipliers except the 0.0001. If the initial capacitance of the bridge is taken into consideration, an accuracy of ±1% or ±2 micromicrofarads can be obtained on this 0.0001 multiplier range over the main decade from 1.0 to 10. Below 100 micromicrofarads the error gradually increases, even if the zero correction is applied, to ±4 micromicrofarads as zero is approached.

The true capacitance of a specimen is the difference between the initial bridge setting and the setting with the specimen connected.

The bridge is intended primarily for the measurement of small capacitances and has consequently been made most sensitive on the low-capacitance multiplier position. On the 10 multiplier it is difficult to realize the accuracies specified, although the bridge elements are accurate to the figures given.

Dissipation Factor Range: 0 to 50%.

Dissipation Factor Accuracy: Within 1.5% of full-scale reading for all capacitance multipliers except 0.0001. On the 0.0001 capacitance multiplier measurements to approximately 1.5% of full-scale reading can be maintained, provided the initial dissipation factor readings are taken into consideration. The true dissipation factor can be calculated from the following expression:

$$D = \frac{D_2C_2 - D_1C_1}{C_2 - C_1}$$

where D_1 and C_1 are the initial capacitance and dissipation factor readings; and D_2 and C_2 are the capacitance and dissipation factor readings with the specimen connected. All values of C are in micromicrofarad values of D in percent. This computation is necessary only when measuring capacitances less than 100 μμf.

Note that the bridge reads in dissipation factor (RωC), which is related to power factor as the cotangent of the loss angle is to the cosine. The difference is negligible for power factors less than 10%.

Voltage Applied to Unknown: The voltage impressed across the series combination of unknown and standard condensers is approximately 80 volts. Since the capacitance of the standard is 0.01 μf, the voltage across the unknown can be calculated from the following expression:

$$V_x = \frac{0.01}{0.01 + C_x} 80$$

where C_x, the capacitance of the unknown, is expressed in microfarads.

INSTALLATION

1. Connect bridge to 100-130 volt, 60-cycle, a-c line by means of the cord and plug supplied. The input power is about 15 watts.
2. Ground the bridge at panel terminal G.
3. Turn on power (ON-OFF) switch.

OPERATION

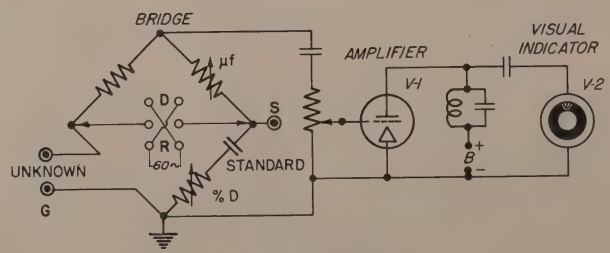
1. Connect the condenser under test to the UNKNOWN terminals, making sure that its grounded terminal is connected to the bridge terminal engraved G. When measuring three-terminal condensers, connect the third terminal to terminal S on the panel.
2. If the approximate capacitance is known, set the MULTIPLY BY and CAPACITANCE dials to this value. If the approximate value is not known, set the SENSITIVITY control at about 5 and adjust the MULTIPLY BY switch until the pattern on the electron-ray tube opens.
3. Adjust the CAPACITANCE and POWER FACTOR dials until a null is reached, i.e., until the pattern on the electron-ray tube is at maximum deflection when the sensitivity is at maximum.
4. A bridge voltage supply reversing switch (engraved D and R) is mounted on the panel. When making measurements in the presence of strong electrostatic fields, a correct result can be obtained by averaging the readings obtained on the two positions of this switch.

PRECAUTIONS

1. Do not use CRL dial below 1 except for measurements less than 100 micromicrofarads.
2. Sensitivity is best when power supply has good waveform.

GENERAL RADIO COMPANY CAMBRIDGE, MASS., U.S.A.

Form 497-BG



TYPE 740-B CAPACITANCE TEST BRIDGE

The Type 740-B Capacitance Test Bridge is a 60-cycle bridge for the measurement of capacitance and power factor. The circuit, shown schematically below, is that of the conventional capacitance bridge. The null indicator consists of a tuned amplifier and an electron-ray tube.

RANGE AND ACCURACY

Capacitance Range: 5 μμf to 1100 μf.

Capacitance Accuracy: Within ±1% over main decade of CRL dial (1 to 11) for all multipliers except .0001.

Within ±1.5% or ±3 micromicrofarads, whichever is the larger, on the .0001 multiplier on the main decade of the CAP. dial. Below 100 micromicrofarads the error gradually increases to ±5 micromicrofarads as zero is approached.

Corrections for bridge zero capacitance are unnecessary because the zero capacitance value is negligible.

Dissipation Factor Range: 0 to 50%.

Dissipation Factor Accuracy: Calibration within ±3/4 of the smallest division for all capacitance multipliers except .0001.

On the .0001 capacitance multiplier a correction of 0.3% should be subtracted from the dial reading. When this correction is made the calibration is within ±2 divisions on the X1 multiplier and within ±1 division on the X10 multiplier.

On the lowest and highest capacitance ranges, where the sensitivity of balance is lower, this accuracy can be obtained by interpolation.

Note that the bridge reads in dissipation factor (RωC), which is related to power factor as the cotangent of the loss angle is to the cosine. The difference is negligible for power factors less than 10%.

INSTALLATION

1. Connect bridge to 100-130 volt, 60-cycle, a-c line by means of the cord and plug supplied. The input power is about 15 watts.
2. Ground the bridge at panel terminal G.
3. Turn on power (ON-OFF) switch.

OPERATION

1. Connect the condenser under test to the UNKNOWN terminals, making sure that the low terminal (if any) is connected to the bridge terminal engraved LOW.
2. If the approximate capacitance is known, set the MULTIPLY BY and CAPACITANCE dials to this value. If the approximate value is not known, set the SENSITIVITY control at about 5 and adjust the MULTIPLY BY switch until the pattern on the electron-ray tube opens.
3. Adjust the CAPACITANCE and POWER FACTOR dials until a null is reached, i.e., until the pattern on the electron-ray tube is at maximum deflection when the sensitivity is at maximum.

PRECAUTIONS

1. Keep supply line away from the UNKNOWN terminals and samples being measured. This is extremely important when measuring on .0001 capacitance multiplier.
2. Do not use CRL dial below 1 except for measurements less than 100 micromicrofarads.
3. Sensitivity is best when power supply has good waveform.

POLARIZING VOLTAGE

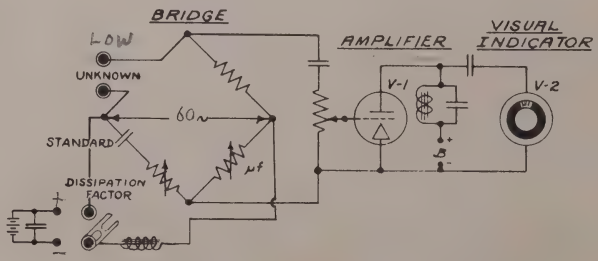
A d-c polarizing voltage (not over 500 volts) can be introduced at the DC and COND. terminals. Batteries are recommended as the source of polarizing voltage rather than an a-c rectifier filter system. The smallest available battery that will give the desired voltage is satisfactory because the only current drain is that caused by leakage in the condenser under test.

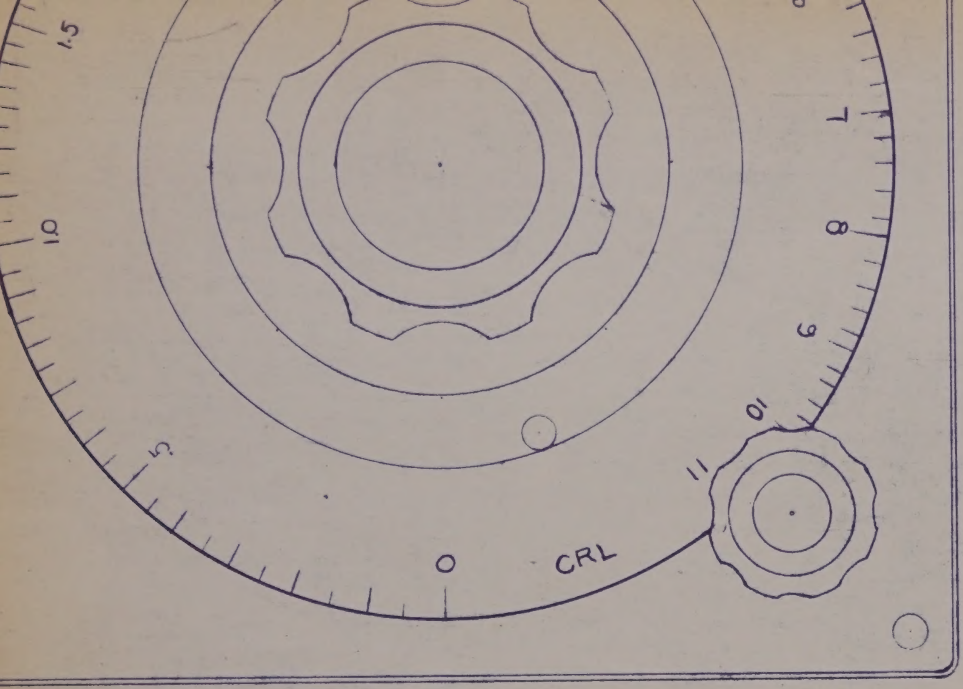
Connect a condenser (10 μf or larger) across the d-c supply in order to avoid a drop in the 60-cycle bridge voltage caused by the internal impedance of the d-c supply.

If an a-c operated power supply is used, its capacitance to ground must be low, because this capacitance is shunted across the standard condenser. The presence of a-c ripple may reduce the sensitivity of balance.

Make sure that the polarity of the voltage is correct for the condenser under test. A simple convention to follow is to connect the negative terminal of the electrolytic condenser under test to the LOW terminal of the bridge and the negative side of the d-c source to the terminal that carries the short-circuiting link.

When no polarizing voltage is used, the DC and COND. terminals should be shorted with the link provided.





OUT

TEST BRIDGE

NO.	CHANGE	APP.	DATE	NO.	CHANGE	APP.	DATE
1	Unknown terminals						
	Mod + rearranged	AGT	1-2-40				
2	Panel stud Added	AGT	3-2-99				
3	Panel stud moved 5/32	MRM	12-23-48				

740-BG CAP. TEST BRIDGE

GENERAL RADIO CO.

CAMBRIDGE, MASS.

DATE 3-29-39 DR. STC TR. CH.

DWG. NO. 740-10D

TYPE 740-B CAPACITANCE TEST BRIDGE

The Type 740-B Capacitance Test Bridge is a 60-cycle bridge for the measurement of capacitance and power factor. The circuit, shown schematically below, is that of the conventional capacitance bridge. The null indicator consists of a tuned amplifier and an electron-ray tube.

RANGE AND ACCURACY

Capacitance Range: 5 μμf to 1100 μf.

Capacitance Accuracy: Within ±1% over main decade of CRL dial (1 to 11) for all multipliers except .0001.

Within ±1.5% or ±3 micromicrofarads, whichever is the larger, on the .0001 multiplier on the main decade of the CAP. dial. Below 100 micromicrofarads the error gradually increases to ±5 micromicrofarads as zero is approached.

Corrections for bridge zero capacitance are unnecessary because the zero capacitance value is negligible.

Dissipation Factor Range: 0 to 50%.

Dissipation Factor Accuracy: Calibration within ±3/4 of the smallest division for all capacitance multipliers except .0001.

On the .0001 capacitance multiplier a correction of 0.3% should be subtracted from the dial reading. When this correction is made the calibration is within ±2 divisions on the X1 multiplier and within ±1 division on the X10 multiplier.

On the lowest and highest capacitance ranges, where the sensitivity of balance is lower, this accuracy can be obtained by interpolation.

Note that the bridge reads in dissipation factor (R&C), which is related to power factor as the cotangent of the loss angle is to the cosine. The difference is negligible for power factors less than 10%.

INSTALLATION

1. Connect bridge to 100-130 volt, 60-cycle, a-c line by means of the cord and plug supplied. The input power is about 15 watts.
2. Ground the bridge at panel terminal G.
3. Turn on power (ON-OFF) switch.

OPERATION

1. Connect the condenser under test to the UNKNOWN terminals, making sure that the low terminal (if any) is connected to the bridge terminal engraved LOW.
2. If the approximate capacitance is known, set the MULTIPLY BY and CAPACITANCE dials to this value. If the approximate value is not known, set the SENSITIVITY control at about 5 and adjust the MULTIPLY BY switch until the pattern on the electron-ray tube opens.
3. Adjust the CAPACITANCE and POWER FACTOR dials until a null is reached, i.e., until the pattern on the electron-ray tube is at maximum deflection when the sensitivity is at maximum.

PRECAUTIONS

1. Keep supply line away from the UNKNOWN terminals and samples being measured. This is extremely important when measuring on .0001 capacitance multiplier.
2. Do not use CRL dial below 1 except for measurements less than 100 micromicrofarads.
3. Sensitivity is best when power supply has good waveform.

POLARIZING VOLTAGE

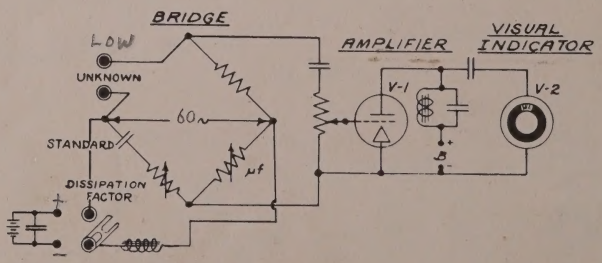
A d-c polarizing voltage (not over 500 volts) can be introduced at the DC and COND. terminals. Batteries are recommended as the source of polarizing voltage rather than an a-c rectifier filter system. The smallest available battery that will give the desired voltage is satisfactory because the only current drain is that caused by leakage in the condenser under test.

Connect a condenser (10 μf or larger) across the d-c supply in order to avoid a drop in the 60-cycle bridge voltage caused by the internal impedance of the d-c supply.

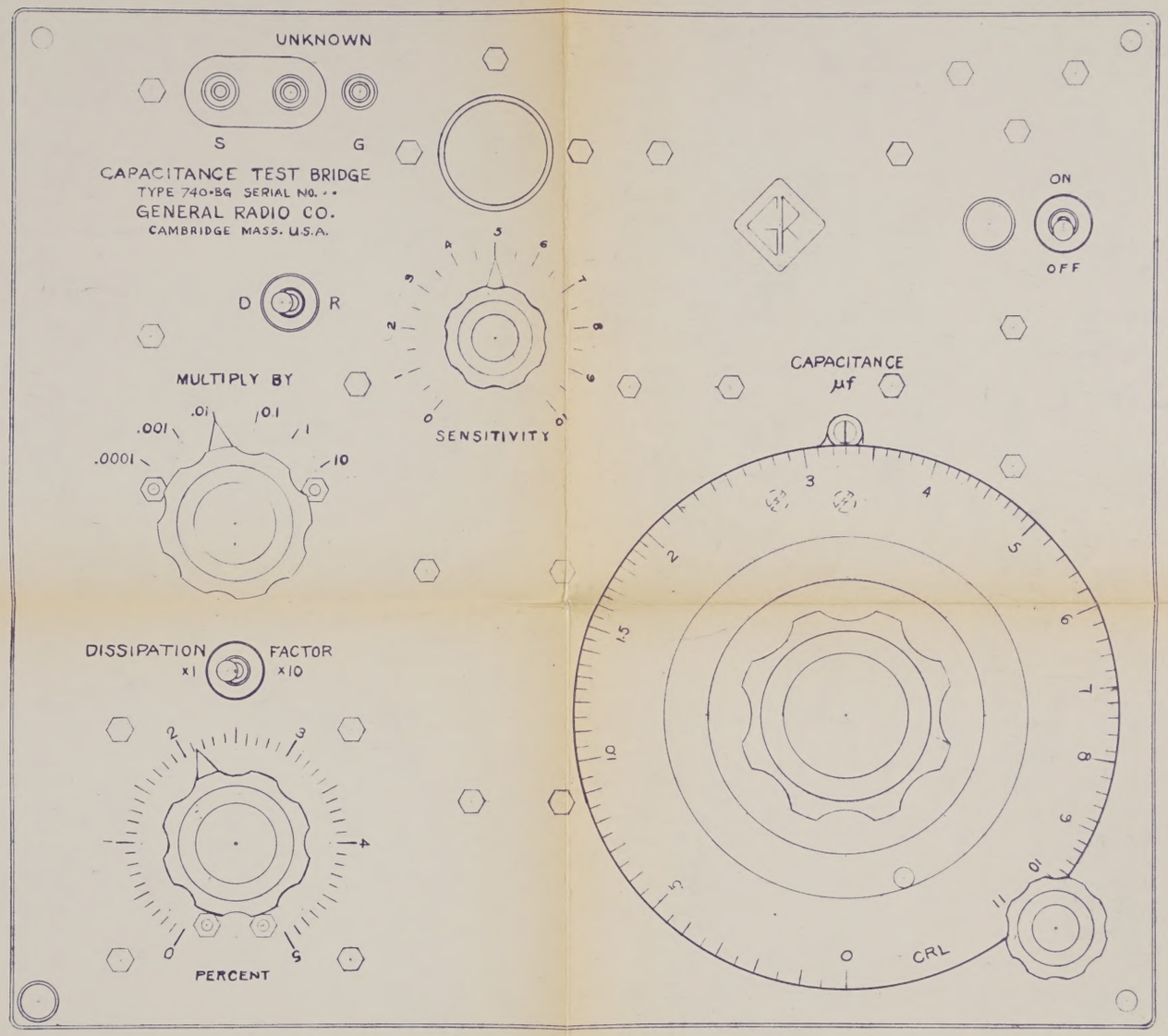
If an a-c operated power supply is used, its capacitance to ground must be low, because this capacitance is shunted across the standard condenser. The presence of a-c ripple may reduce the sensitivity of balance.

Make sure that the polarity of the voltage is correct for the condenser under test. A simple convention to follow is to connect the negative terminal of the electrolytic condenser under test to the LOW terminal of the bridge and the negative side of the d-c source to the terminal that carries the short-circuiting link.

When no polarizing voltage is used, the DC and COND. terminals should be shorted with the link provided.



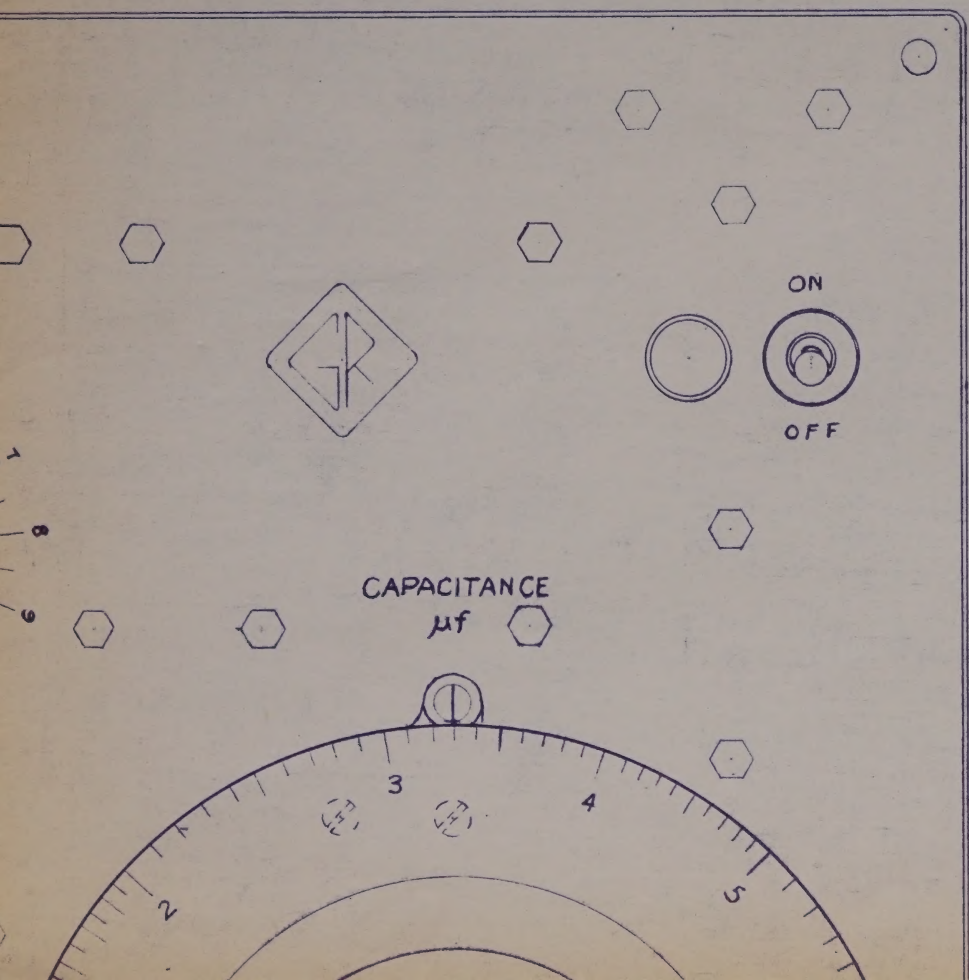
INACTIVE



PANEL LAYOUT
FOR
740-BG CAPACITANCE TEST BRIDGE

NO.	CHANGE	APP.	DATE	NO.	CHANGE	APP.	DATE
1	Unknown terminals Mod & rearranged		1-2-40				
2	Panel stud Added		3-2-49				
3	Panel stud removed	MKM	12-23-48				

740-BG CAP. TEST BRIDGE
GENERAL RADIO CO.
CAMBRIDGE, MASS.
DATE 3-20-39 DR. SPECTR. CH.
DWG. NO. 740-10D

DWG. NO. 140-10D

INACTIVE